AUGUST 1994 Issue #36

Radio Fun

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"The beginner's guide to the exciting world of amateur radio."

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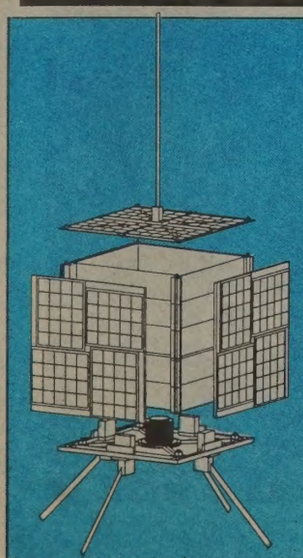
Take Your Hobby to the Top Band!

Are you ready to move up to 10 GHz? Take advantage of the dog days of summer by experimenting with tropospheric ducting on microwave frequencies. Turn to "Upgrade . . . Don't Stop Now," on page 24. (Photo by Gordon West WB6NOA.)



What would it take to get you up and running on amateur satellites? You'll find out in this issue. Look inside to find the articles: "Robot Mode K" on page 4, and "Satellite Overview" on page 6. Also in this issue, build your own scale model of AMSAT's Phase 3D satellite!

Top Cop

According to *Electronic Engineering Times*, a group of students at the Massachusetts Institute of Technology recently showed they were "complete engineers" by arranging a rather sophisticated end-of-semester prank. The article quotes Bob Rivers, Human Resource Director at Bose Corp., saying the MIT students displayed a number of desirable qualities his company looks for when hiring engineers: initiative, leadership, technical knowledge, planning and organization, and the ability to handle stress.

So, what did the students do? They somehow constructed an exact replica of a campus police car—right down to a bag of Dunkin Donuts—and lifted it to the dome of one of MIT's main buildings, all in complete secrecy. As you can imagine, the story was highly photographable, and made all the evening newscasts in Boston. Rivers says these young engineers also have another trait that is very desirable in the workplace—a sense of humor. *TNX Electronic Engineering Times, Issue 797, May 16, 1994.*

New kHz on the Block

The Federal Communications Commission will hold frequency spectrum auctions this fall, according to Chairman Reed Hundt. The frequencies heading for the auction block are to be used to expand mobile communications, which Hundt says has the potential to become one of the country's largest industries by the end of the century, with at least 87 million customers.

Hundt also says he wants the FCC to promote competition in the communications industry, especially for cable TV, so rate regulation can eventually be eliminated. *TNX Westlink Report, No. 671, April 30, 1994.*

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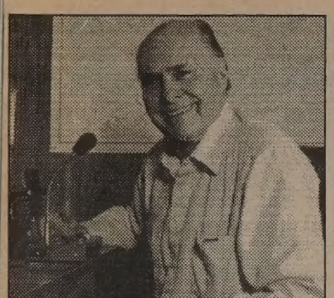

QLF

by Wayne Green W2NSD/1

If You're So Smart . . .

OK, as a ham you are a communications expert. Well, you're supposed to be. That's what you've conned your non-ham friends into thinking, right?

So what do you really know about communications, other than kerchunking some repeaters or adding still more garble to a pileup? If someone were to ask you about pagers, what could you tell them? How much do they cost? What's their range? Where do you get 'em? What frequencies do they use? What services are available? Can I use some just around my own business?

And what can you tell people about fax-modems? The Internet, CompuServe, Prodigy, bulletin board systems, and so on?

There are almost endless communications services out there. Now, if you, as a bona fide communications expert, can't answer even simple questions about 'em, imagine how confused the average business person is when faced with choices of telephone switches, cellular telephones, teleconferencing, security systems, computer networking, and so on. Dealing with all this is so far beyond the average person that you have a tremendous opportunity to make some money—once you know your stuff.

No, you don't know all the answers now, but with your ham background at least you can understand the questions and you have some clues on where to find the answers. Knowledge is not only power, these days it's money. There are at least 10 million small businesses that could benefit from better communications, security, and computer systems. That's one heck of a market.

How long do you think it would take you to become an expert on pagers, just to pick one field at random? You need to get literature from the manufacturers, dealers, and service companies. You'd want to read a couple books on the subject. Are we talking six months? One month? A week?

Next you'd want to visit some of the companies involved in the business and talk with them. Find out their problems, what success stories they have, which equipment they think works best, and so on. Couple of months in your spare time?

Now that you have a good understanding of the technology and the players, and have the contacts you need, what should you do next? My recommendation would be to sit down at your computer and write a brief handbook on the subject—maybe 32 pages. Write it for the non-technical average business person. Explain the benefits this service provides and show how the costs are small compared to the benefits. You can make the handbook look professional by printing it on a laser printer. The first hundred copies can be made on a copy machine. That's the way I do all of my booklets until the demand gets out of hand.

This will provide you with some sales literature for your new communications consulting service. With your name as the author, this certifies that you are an expert. Now you're in a position to send letters to local businesses offering the first phase of your communications consulting services.

Once you know your stuff on pagers it's time to pick the next business you're going to learn. If you've made any efforts toward selling your pager expertise, by now you'll know what questions buisness people are asking about other communications services. You might tackle fax-modems next.

Same deal. Get the literature. Read the books. Talk with the manufacturers, dealers, and services. Help some friends for free, learning on their money. It's always best to use other people's money (OPM) as much as possible when you are learning.

Within a year, if you make any kind of an effort at all, you'll be Mr. Communications in your town, and you'll have dozens of small businesses turning to you for solutions. In the communications business you make money on sales, on installations, and on service. Great business. All communications equipment breaks, so the service business is wonderful. And computers, being the most complicated of all, break the most often. Plus there are viri, incompatible software, static electricity, errant magnets, and so on to help keep you living comfortably.

Oh yes, it won't hurt to become an expert on magnetic fields and go around with your gaussmeter and help people avoid possibly harmful fields. There'll be a very inexpensive gaussmeter on the market soon that does a wonderful job.

And when your customers want to know whether cellular telephones are harmful or not, you'll know the answer and be able to give them a reprint of an article from *73* on the subject.

There's no reason for any ham with even the slightest amount of gumption not to be living in comfort and have as big a ham station as he wants. Or she, as a balm to militant feminists.

Expert Help Needed

If you are already an expert on any phase of communications, how about writing an article for possible publication in *73* to help newcomers to the field? They need to know the suppliers and publications, have a list of recommended books, know how distribution works, and know what frequencies and services are available and their average cost—things like that.

If we can get a series of articles to help *73* readers come up to speed on business communications services, that'll help a bunch of hams build some spare-time income, and maybe be able to take their new consulting businesses full-time as entreprencurs. So what's out there in BBS software? In security products and services? In video conferencing? Satellite services?

Or are you happy with your old ham gear and not enough money to even buy a subscription to *Radio Fun?* Tsk. The money is out there in great big gobs, you just have to make a little effort to grab it. And that means turning off the ball games and doing some homework instead. Get off the couch, put down that can of beer, brush off the pretzel crumbs, and get cracking. I don't care if you're 20 or 70, you can learn new things and it'll be some of the best fun you've ever had. Heck, I'm almost 72 now and I'm tackling a whole new branch of physics—one which not even the best scientists in the world understand yet—cold fusion. Now *that's* exciting.

I'd love to know more about communications, so I'll be reading any articles submitted for my own edification and well as yours. That means they've got to be simple enough so I can understand them. RF

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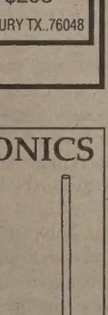

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RS-12 Robot Mode-K

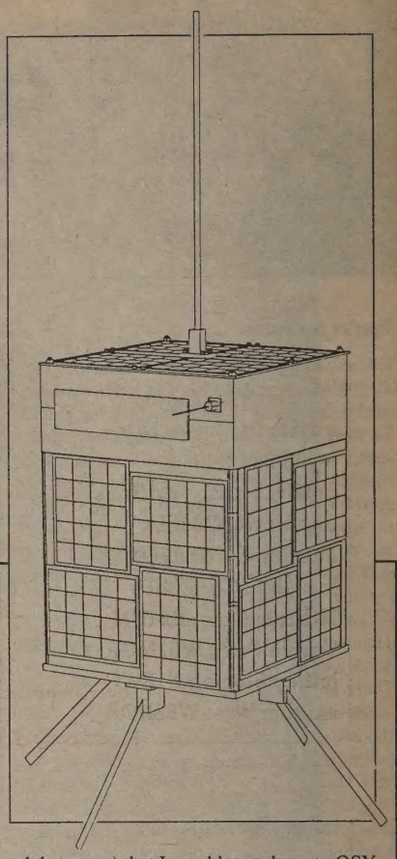
The poorest person's satellite.

by Theodore Walker, Jr. WB4MFI

Radio Sputnik (RS) Mode-A is frequently recommended as the easiest and least expensive place to begin amateur satellite work. This is because of minimal hardware requirements. A 2 meter transmitter, a 10 meter receiver, and a modest antenna for each of the two bands equals a "poor-boy satellite station." But, there is an even less hardware-intensive place to start. The RS-12 robot can be worked in Mode-K with almost any modestly powered HF transceiver capable of split CW operation.

Remember that Mode-K indicates a 10 meter downlink and a 15 meter uplink. The RS-12 robot calls CQ on 29.454 MHz. Answer the robot on 21.130 MHz. The robot will respond on 29.454 MHz. The robot's 10 meter downlink signal is strong enough to come through (RST 549 to 589) on the 15 meter uplink antenna, so there is no need to fiddle with two antennas. I worked the RS-12 robot with a Kenwood TS-140S, running 40 watts of CW into a mobile vertical antenna (the Texas Bugcatcher) angled out from an inner-city second floor apartment balcony. My QSO with the RS-12 robot went like this: The robot called, "CQ CQ de RS12 QSU 21130 kHz AR." I answered, "RS12 de WB4MFI AR." The robot responded, "WB4MFI de RS12 QSL NR 0574 OP ROBOT TU SW QSO NR 0574 73 SK." (Please note that I used an electronic keyer because the robot does not copy less than perfect CW. Also, AR must be sent as a single character.) One modest rig, one modest 15 meter antenna, and an electronic keyer is all the hardware needed to work the RS-12 robot in Mode-K.

For those who appreciate white noise, it is a simple matter to listen to 29.408 MHz (beacon) and 29.454 MHz (beacon and robot) until the satellite happens to come into view. Otherwise, I recommend an OSCAR LOCATOR or the use of InstantTrak software to indicate precisely when the satellite will appear. InstantTrak is available from AMSAT, and *The AMSAT Journal* (tel. 301-589-6062) provides recent orbital elements. Other helpful written resources include *The RS Satellites Operating Guide* by G. Gould Smith WA4SXM, and *The Satellite Experimenter's Handbook* (ARRL book) by Martin Davidoff K2UBC. RF



Waiting for the Russians: Satellite Adventures in the Caribbean

by Bill Meara N2CQR/HI8

It was 1 a.m. and the satellite was approaching from the south. Our computers had followed it as it passed over Australia and crossed the South Pole. Now it was zipping through the night sky over South America at 14,000 miles per hour, 600 miles above the surface of the earth. The computers told us that it would rise over Santo Domingo's moonlit Caribbean horizon at precisely 1:32 a.m. local time. We were ready for it.

Luis Ernesto HI8LEZ was seated in his shack across town. We both had our 2 meter FM rigs on 145.6 MHz simplex—the net frequency for Radio Club Dominicano. At more civilized hours this frequency was filled with the friendly daily chatter of our club, but at 1 a.m. we had the frequency entirely to ourselves. We were getting ready to do something a little different—we were waiting for a Russian.

With our equipment ready and double-checked, there was nothing to do but wait. We passed the time by shooting the breeze on 2 meters. The conversation was in Spanish and the subject matter was ham radio. Luis Ernesto and I had been hams for many years. Although we had grown up in different countries, our involvement in amateur radio had provided a lot of common ground. As the bird flew over Bolivia we spoke of how good it was to be once more involved in a late-night ham radio adventure. There is something special about late-night radio work—the darkness and the quiet add an element of mystery and intrigue. With sunspots scarce, where there had once been exotic DX our radios were lately emitting nothing but a disheartening hiss. But now the Russians had put us back in the late-night radio business.

We were waiting for the Russian amateur radio satellite RS-12. Launched in 1991 and riding aboard the COSMOS-2123 navigation satellite, RS-12 is currently set up for Mode K operations. That means it takes signals (CW or SSB) from a 15 meter uplink passband and retransmits them on a 10 meter downlink. RS-12 is one of the easiest of the EASY-SATS.

The members of Radio Club Dominicano had been interested in satellite communication for some time, but we had lacked easily accessible information on satellite orbits—information on when the "birds" would be visible to us. Early in January 1994 I had the good fortune of conversing with two U.S. hams (W9CZI and AA1GW) who are satellite enthusiasts. They had kindly provided me with the times for some good RS-12 passes for the Dominican Republic. With much trepidation and lots of luck, I managed to make my first satellite QSO. I'd read that for many hams their first satellite QSO was as exciting as their very first contact or their first DX. Now I understood! I was elated to hear my signal coming back to earth on the 10 meter downlink, and even more pleased when W9GUP answered my CQ. I felt that my old rig (HT-37, Drake 2B and dipoles) had entered the space age! I had successfully defied a declining sunspot count! I was hooked.

Fortunately, satellite tracking software arrived from AMSAT very quickly. I got the ORBITS II program and ran it without difficulty on my old 286 CGA graphics computer. The acquisition of this software was a major step forward in our space program. Now at a glance we could see the precise locations over the earth of all the satellites we were interested in. Also, we could easily ask the computer to tell us precisely when the satellite would be next appearing over the horizon. I'd advise anyone interested in satellites to make the purchase of tracking software their first step. Aside from being indispensable to your operations, the software in itself is a lot of fun. Several of us have found ourselves mesmerized by the map of the world and the little numbers representing the various birds. At first it seems unlikely that this little display represents actual objects in space, but confirmation comes when you tune to the beacon frequency of one of the spacecraft and hear the signal just as the "footprint" of the satellite crosses your QTH!

Now Luis Ernesto was going to try for a QSO. As we spoke on 2 meters, my tracking program showed the northern edge of the satellite's footprint moving across the Caribbean and approaching our island.

"Let's tune for the beacon!" Right on cue, there it was—faint CW on 29.408 sending telemetry and the callsign RS-12. We waited a few minutes for the satellite to rise in the sky.

"O.K. Luis Ernesto—call CQ and I'll try to find you on the downlink!"

I tuned the 10 meter downlink band but somehow missed his signal. By the time I found him, he was already a satellite communicator! He worked five stations on that first pass! Now there were two satellite addicts in the DR! During the days ahead Luis Ernesto and I both lost lots of sleep because of the Russian satellite! The orbital trajectory continued to put the bird over the Dominican Republic at around 1 a.m. local time. We joked about how perilous it would be to explain our fatigue to co-workers by explaining that we had to stay up late because we needed to talk to a Russian satellite that flies over our houses every night at 1 a.m.! (For someone who works in the American Embassy, this is an especially perilous explanation!)

RS-12 is a lot of fun and provides amateur radio operators the opportunity to toy with the heavens! While attempting to coordinate a contact with HI8P (The Dominican Republic's only life member of AMSAT), I was having a bit of trouble finding him in the downlink. Headphones on, I was carefully scrutinizing the 10 meter band. Suddenly I heard—from space—the sound of a phone ringing! How strange! ("What's that, Spock?") It took me a moment to realize that in my excitement I was gripping the push-to-talk and that the headphones had prevented me from hearing my phone ringing—except via the satellite path. The phone call was from HI8P—I congratulated him on his first RS-12 connection!

RS-12 also provides a great opportunity for friendly assistance to interested fellow hams—Outer-Space Elmering. Newcomers to the satellites really need some information and guidance—frequencies, how to cope with Doppler and, above all, info on when the bird will be overhead. Anyone who has made a few contacts and has a tracking program running is in a position to help others get into this exciting and different mode. One Sunday morning I told a friendly group of DXers on 20 meter SSB (K8JP and the group) that I would soon have to QSY because the satellite was coming over the North Pole. That was enough to get them interested. Within minutes the whole group had shifted to the satellite frequency and had made satellite contact. Later—back on 20 meters—they chastised me for afflicting them with a new addiction!

The ROBOT

In addition to providing opportunities for contact with other earthlings, the RS-12 satellite allows you to make your first extraterrestrial QSO! There is a Robot onboard. I had heard the Robot but I'd never been able to work him. One morning the heavens were aligned properly: The satellite's footprint had moved away from the heavy activity in the Eastern U.S. but—from my Caribbean perch—I still had the bird in sight. RS-12 was calling "CQ." I gave him a call in the proper format and, miracle of miracles, a robot in outer space responded to my call. The ROBOT is a very courteous ham—he says "thank you," wishes you 73, and follows up with a QSL (via a manager in Germany!) FB!

Obviously I've really enjoyed getting involved in the satellites. I've found this part of our hobby to be a great way to learn about space sciences and physics. Contrary to popular opinion, the satellites do provide lots of opportunities to employ home-brew gear and—as my old tube-type station demonstrates—you don't need to buy a small-scale version of the Johnson Space Flight Center to get into the fun. An old version of the *Satellite Experimenter's Handbook* provided some sage advice: Start out simple and take things one step at a time. Get some experience on the EASY-SATS and then move on—little by little, receive system first—to the more advanced satellites. Each time you work through a new satellite you'll get the satisfaction that comes from technological conquest, along with something of the thrill DXers get from "working a new one."

Have fun! See you on the satellite! 73! RF

Radio Fun

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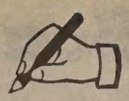
letters



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Jim Lyons N2WSN, V.P. Engineering, Ameco Corp. There are a few additions and rewording that should be made to the article on the Ameco PT-3. *[See Gordon West's review of the Ameco PT-3 RF Preamplifier in "Upgrade . . . Don't Stop Now," March 1994.-Ed.]*

The *idea* for the product is 15 years old, with the PT-1 being the first unit introduced. Over the years, there have been changes and improvements to the product. The current model PT-3 Mr. Gordon West tested is the latest revision which was introduced last year and comes from the venerable Ameco Corporation, 224 East Second Street, Mineola NY 11501; telephone: (516) 741-5030.

The basic PT-3 consists of an LC-tuned RF amplifier that covers all amateur bands from 160 through 6 meters. The amplifier is a dual-gate, low noise, FET design.

Larry Vogt N4VA, FAIRS Training Director, Floyd VA The Foundation for Amateur International Radio Service, Ltd. (FAIRS), along with the Guyana Amateur Radio Association, has begun a new project to encourage the growth of amateur radio in Guyana. We will be working together to establish a technical library and a club station in Georgetown, the capital of Guyana. These facilities will provide access to those who cannot afford their own equipment or supplies. We will also assist in the areas of training (including operating procedures, Morse code, and emergency communications) and in public demonstrations of amateur radio.

Now that the new project has been launched, we at FAIRS would like to invite you to help with the effort. FAIRS is a public foundation with IRS 501 (c) (3) status, which relies entirely on volunteers and their donations of time, energy, supplies and funds. Won't you consider allocating a portion of your 1994 charitable contributions to this worthwhile amateur radio project? The value of any contribution you make, either as funds, equipment, or materials, is tax deductible in the U.S.

The following items are needed:

Training material: code practice oscillators, keys, training tapes, technical courses, technical books, license manuals.

Supplies: soldering irons, VOMs, coax connectors, etc.

Equipment: antenna kits, antennas, packet controller, dummy load, SWR bridge, transceivers for HF and VHF, etc.

Magazine and newsletter subscriptions.

This may seem like a lot to ask for, but with a little help from many individuals, the project will be a huge success. Not much is available in Guyana, so FAIRS hopes you will want to become a part of this exciting endeavor. If you can help with any donation of funds, supplies, or equipment, please send it to: FAIRS Guyana Project, P.O. Box 341, Floyd VA 24091.

Maynard Raggio N9PTG, Bloomington IN 47401 I was pleased to receive several complimentary issues of *Radio Fun* after becoming a licensed amateur two years ago (Tech, now Tech +). I thought it was a very good publication, and passed my copies along to my 12-year-old son, who also became licensed later in the year (N1NHH/9). The local gun club, to which I belong, has included a book program in its activities and budget for many years, funding subscriptions to shooting-sports publications for the local public library and 10 of the local middle and high schools.

Since I firmly believe that the future of amateur radio as a service and a hobby depends on getting young people involved, I proposed that our local amateur radio club (Bloomington ARC) start a book program by funding subscriptions to *Radio Fun* for some local schools. The idea was met with enthusiasm, and six subscriptions to *Radio Fun* were approved and will be placed with the libraries of local grade schools at the beginning of the fall semester. I envision expanding the program in the future as funds permit. I strongly urge other amateur radio clubs to start a book program in their school libraries. Children love amateur radio, but must be exposed to it first!

Richard M. Franklin N3PIO, Lancaster PA I really enjoy your magazine. Not only does it inform my fiance and myself of developments in amateur radio, it also stimulates our thinking process, which helps us come up with new ideas of our own.

Sherry N3QPB and I got into amateur radio so we could keep in touch with each other while she was fishing and I was hiking at the same time. The hobby has led us in other directions, though. Now we are both involved in search and rescue and look forward to the articles you have in your magazine dedicated to that function.

We are also involved in Sky Warn, the severe storm observers in the amateur radio community. Your magazine provides us with information about that function, too.

Albert Champion KC5CSA, Tulsa OK Wayne—First I want to tell you that I have personally enjoyed every article of yours that I have read, in any magazine or wherever I have found one. Too many times in my life I have found people in a position like yours who have aspired to high ideals to a degree that left their wisdom devoid of any real common sense. I admire your efforts. Please continue.

While taking classes at the Tulsa Technology Center (Vo-Tech) geared toward TV repair, I was encouraged by teachers there who were hams to get a license of my very own. It was not much effort, on top of what I learned in class, to get my Technician Class license. But it came with my own self-imposed rule that "if I can't build it, I can't have it," which seemed to be one of the basic considerations of amateur radio in the first place.

It was something to notice how many of the companies selling equipment sent me advertisements. Out of all the stuff that has passed through my mailbox on its way to the dump, I found one item, your *Radio Fun* magazine, not only entertaining but outright encouraging. Out of all the paper that was used aiming at me to buy something, seemingly requiring enough paper to support the entire spotted owl population, *Radio Fun* was the only thing to actually capture my heart and imagination enough to consider buying a subscription. I hope the cost to the environment was worth it.

Right there, in issue #31, was a review of the Ramsey Electronics FX-146 kit. Joy and jubilation! Here is my subscription. RF

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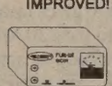

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Hams and Scanners

by Bill Clarke WA4BLC

Is there a scanner in your future? I think it is a distinct possibly. After all, most modern 2 meter transceivers (handhelds and mobile/fixed rigs) can be used as scanning receivers (but not transmitters, of course) outside of the 144 to 148 MHz ham band. Most cover from 130 to 175 MHz FM and a few include the aviation band (AM signals) starting at 108 MHz. This spread provides access to public service frequencies in the 150 to 170 MHz area, including fire, police, marine, weather, and many others.

The typical 2 meter rig can be programmed to scan the spectrum between two preset frequencies or to scan specific frequencies placed into memory. Unfortunately, most are slow in stepping from one frequency to another. I say slow, as many of the current dedicated scanner receivers can check as many as 100 (or more) frequencies a second.

Hear What?

The public safety frequencies are typically the most often monitored by listeners (scanner operators). There are few of us around who would not like to get the news before it is on the TV or in the newspaper. But there is also a real need for hams to know how to use scanners.

In order for the ham community to interface with the public safety community, as we must in public service, we need to know what law enforcement agencies, fire departments, or other branches of local government are doing (both to be informed and to stay out of the way). This is particularly true during natural disasters such as forest and brush fires, earthquakes, hurricanes, floods, and tornadoes.

Ham Uses

Other than listening to the local sheriff, what can hams do with a scanner? Scanners allow you to continuously monitor repeaters, not just on the bands your VHF/UHF rig operates on, but *all* of them. The typical scanner covers from 30 to 1000 MHz, with some areas not covered including: television bands and the cellular telephone band. The former is deemed not worth listening to and the latter to provide "security" (as mandated by law) to the cellular industry.

This wide frequency coverage gives instant access to 6 and 2 meters and to the 220 MHz and 440 MHz bands. You can check on activity on the various bands before you go to the effort and expense of becoming active on them. Perhaps there is little or no activity on certain bands in your locale.

With the more sophisticated scanners comes a capability referred to as *search and store* and/or *search and count*. This provides a means of checking the activity on specific frequencies. For example, after operating within a frequency boundary of 147.000 to 147.400 MHz, some scanners will auto-store all active frequencies in memory. By checking the memory, you can determine if any frequencies remain unused (i.e. an unused 2 meter repeater pair). The search and count feature goes a little further by giving totals of hits (receptions) noted by frequency. Hit totals and unused frequency pair lists can be used to prove lack of use and to prod repeater coordinator approvals.

Some of the latest hand-held scanners cover not only VHF and UHF, but frequencies starting at 500 kHz (some as low as 100 kHz) in AM and SSB modes as well. They offer complete ham-band receiver coverage of all our frequently-used spectrum in one palm-sized unit. Pretty amazing huh?

Equipment

I recommend that hams wishing to purchase a scanner contact their favorite amateur gear supplier. Being very familiar with amateur radio, they can guide you to what receiver(s) would be most appropriate for your use. Scanners are also available from Radio Shack and other electronics stores and from mail-order magazine advertisements.

Although nearly any antenna (including the built-in type that most scanners are factory-equipped with) will work, I recommend a good outside multiband antenna such as the omnidirectional discone or directional log periodic. Both are very widebanded, typically providing receive/transmit from 50 to 1300 MHz. Connect your antenna to the receiver with RG-213, or other low-loss coax feedline. Remember, coax losses increase with frequency. N-connectors would not be considered overkill.

Caveat

Do not monitor law enforcement frequencies while in your automobile, as you could find yourself in violation of the law. (These laws vary from state to state.) The current policy of allowing licensed amateur radio operators to have receivers in their automobiles *capable* of receiving police frequencies does not mean you are permitted to engage in such mobile monitoring. The key word here is *capable*, meaning frequency coverage only—*not actual use!*

Information Sources

To get you started, I suggest purchasing the *Pocket Frequency Guide* from DX Radio Supply, P.O. Box 360, Wagontown PA 19376; (215) 273-7823). To order, send two dollars and an SASE. The guide is a water-resistant laminated card giving the VHF and UHF frequency allocations for the various services, including public safety, utility companies, railroads, telephone, marine, etc. National Scanning Report's 140-page book *Citizen's Guide to Scanning*, a compendium of scanning information of how-tos and where-tos, is also available from DX Radio Supply.

VHF/UHF scanning has become so popular that a bimonthly magazine, *National Scanning*, is now published by the Bearcat Radio Club. For subscription information contact them at Box 291918, Kettering OH 45429. Along with your subscription you will receive a frequency spectrum chart, custom frequency list for your particular county, and associate membership in the Bearcat Radio Club. If you elect full membership you gain access to the club's BBS, including the FCC official database of public service, local and state government, and business licensees. Also included are the U.S. Amateur Operators database and repeater locations.

Additional information relative to scanners can be found in the monthly magazines *Monitoring Times* and *Popular Communications*. Both are generally available at good news stands and magazine stores.

Of note, the above publications have ham radio columns aimed at the SWL and scanner enthusiast.

TNX . . .

A special thanks to EEB (Electronic Equipment Bank), 323 Mill Street NE, Vienna VA 22180, (800) 368-3270, for their expert guidance, support, and loaner equipment while researching this article. RF

Satellite Overview

Take your hobby into space!

by Andy MacAllister WA5ZIB

In April 1959, less than two years after the launch of *Sputnik 1*, Don Stoner W6TNS suggested in the pages of the amateur radio magazine *CQ* that amateurs build a satellite as a relay in space. A group of hams in Sunnyvale, California, accepted the challenge and created Project OSCAR (Orbiting Satellite Carrying Amateur Radio) for the purpose of designing, building and getting an amateur radio payload into orbit.

December 1961 marked amateur radio's entry into the Space Age. It had been 60 years since Marconi's first successful trans-Atlantic transmission, and just over four years since *Sputnik 1* achieved orbit. OSCAR-1 was launched in the place of ballast with the *Discoverer* 36 photo-reconnaissance military satellite. The first hamsat weighed only 10 pounds and looked like a curved breadbox that could be easily carried under one arm. It transmitted "HI" in code on the 2 meter band (on 145 MHz) for 22 days before burning up in the atmosphere.

Since the early days of the amateur radio satellite program there have been many OSCARs. Today we can talk to other hams around the world, send digital messages to remote locations, receive pictures taken in space and study scientific data taken in orbit, all using relatively simple home equipment, through OSCARs and other hamsats now in orbit. It's common to hear satellite chasers discussing their FM exploits via AMSAT-OSCAR-21 or 27, the pictures from Tahiti downloaded from the Korean Kitsat-OSCAR-25, or the new DX station in Iraq heard on 145.890 MHz SSB via AMSAT-OSCAR-13.

A new satellite project is now underway for launch in 1996. It is called Phase 3D. It is the fourth spacecraft built in the high-elliptical-orbit, long-life series of OSCARs, and is an international project involving volunteers in many countries. Phase 1 satellites were low-orbit, short-life types like OSCAR-1, while Phase 2 represents the long-life, low-orbit configuration.

Compared to OSCAR-1, Phase 3D is immense. At launch it will weigh nearly 900 pounds, including fuel for the on-board kick motor. It will be a hexagonal cylinder seven feet across and three feet high. After reaching orbit, the solar panels will unfurl, providing a "wingspan" of nearly 20 feet. Much of the spaceframe has been finished by hams both here and in Germany.

Phase 3D will be given an OSCAR number after it achieves orbit. Phase 3A failed to reach orbit when its Ariane 1 launcher failed in May 1980. Phase 3B became AMSAT-OSCAR-10 in June 1983 and is still somewhat operational today, even though the on-board computer is inoperative. Phase 3C became AMSAT-OSCAR-13 in June 1988 and is currently tremendously popular with its uplink system on the 435 MHz band using downlinks on 2 meters just below 146 MHz and on 13 cm around 2400 MHz.

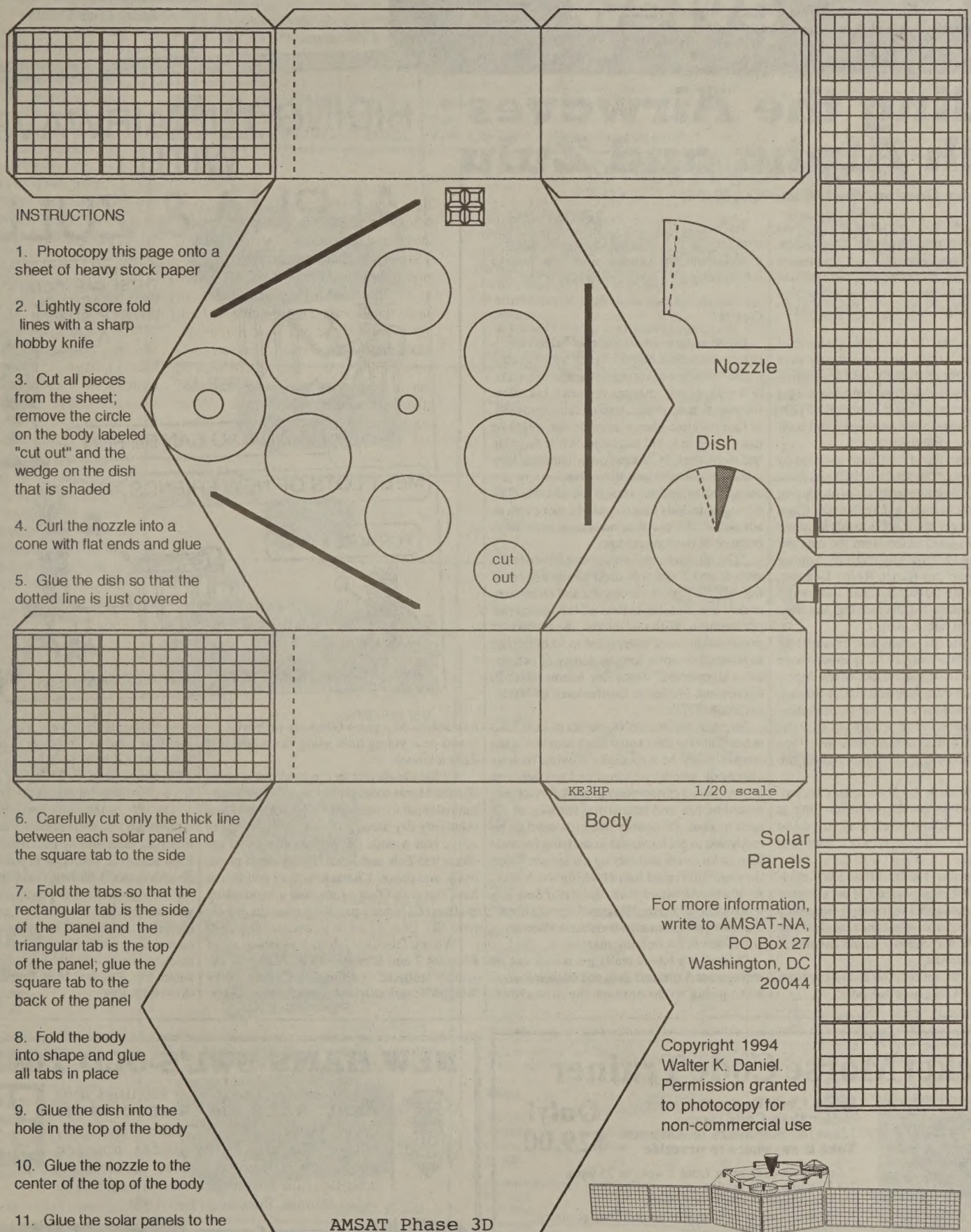
Most amateur radio satellites used for real-time voice and CW communication take a portion of an amateur band and rebroadcast it in another band. The systems are called transponders and employ frequencies from 21 MHz up through the microwaves. Phase 3D does the same, but with some significant improvements. While past hamsats usually carried one or two transponders, Phase 3D has a group of five receivers and five transmitters that can be connected in a number of combinations via computer control. A matrix is formed, allowing combinations of bands comparable to transponders already in orbit, like Mode B using 70-cm uplink signals with a downlink on 2 meters, or as-yet-unheard-of modes incorporating 2 meters up and 24 GHz down. The transponder bandwidths on Phase 3D range from 175 kHz to 500 kHz. Each transponder is larger than most amateur HF bands.

Current high-orbit satellites like A-O-10 and A-O-13 typically require high-power uplink signals or high-gain terrestrial antenna systems. Phase 3D is designed with high-power transmitters on the satellite in conjunction with deployable high-gain antennas for VHF and UHF, and high-gain microwave patch antenna arrays for the other bands. On earth, very small steerable antennas, or even omnidirectional antennas, will be quite sufficient for quality satellite operation. Phase 3D promises to be the most complex and yet easily-used OSCAR. Launch is less than two years away—get ready for the shape of things to come. Build the satellite model on page 7 to get an idea of what Phase 3D is all about and prepare your station for some really great space communications!

More information on the hamsats can be found in *The Satellite Experimenter's Handbook* by Martin Davidoff K2UBC, available from the American Radio Relay League or AMSAT (The Radio Amateur Satellite Corporation). AMSAT can be reached at (301) 589-6062. They have other books and software available for amateur satellite enthusiasts.

See you on the satellites!

Andy writes the monthly column "Hamsats" in 73 Amateur Radio Today. RF


INSTRUCTIONS
1. Photocopy this page onto a sheet of heavy stock paper
2. Lightly score fold lines with a sharp hobby knife
3. Cut all pieces from the sheet; remove the circle on the body labeled "cut out" and the wedge on the dish that is shaded
4. Curl the nozzle into a cone with flat ends and glue
5. Glue the dish so that the dotted line is just covered
6. Carefully cut only the thick line between each solar panel and the square tab to the side
7. Fold the tabs so that the rectangular tab is the side of the panel and the triangular tab is the top of the panel; glue the square tab to the back of the panel
8. Fold the body into shape and glue all tabs in place
9. Glue the dish into the hole in the top of the body
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AMSAT Phase 3D

RF book review

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Riding the Airwaves With Alpha and Zulu

reviewed by Gordon West WB6NOA

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Amateur radio test questions and answers change on a rotational basis every four years. The Novice Class Element 2 and Technician Class Element 3A question pools were revised in July 1993 and were rewritten at junior high school and high school reading levels, respectively.

"This will make the test more easily read and understood by kids, and we certainly want to encourage more kids to pass the entry-level amateur radio ticket and get active on the airwaves," comments Gerald Luecke KB5TZY, a question pool committee participant and book editor for Master Publishing.

Question input has always been solicited by the question pool committee (QPC) and from the amateur radio community at large. During the most recent Novice and Technician Class theory question rewrite, QPC records illustrate virtually zero participation from the amateur community, with most suggestions coming from the American Radio Relay League, Gordon West Radio School, and individual member VECs attending the meeting. But from the ham general public—zip.

General Class questions just changed on July 1, 1994. While many of the questions have been reworded from suggestions of the American Radio Relay League and Radio School, there are no major surprises, and the transition from old questions to new questions on the exam should not affect anyone who has properly studied old or new material for the new test.

But back down at the Novice and Technician Class level—these questions rewritten at junior and high school levels may still cause junior high students to gulp when they read the following:

Novice question N4CO9: "If an SWR reading at the low frequency end of an amateur band is 2.5:1, and is 5:1 at the high frequency end of the same band, what does this tell you about your 1/2-wavelength dipole antenna?" Got the right answer?

Or try this one out on your teen-ager from the Technician Class question pool:

Technician question T5B10: "If a 48,000-ohm resistor is connected to 12 volts, approximately how much current will flow through it?" Specify your answer in micro amps, too.

Got It?

Down at the examination centers, some volunteer examiners might offer a "kids' examination" which would contain the specific question without any changes (by law), but allow for a spoken response, true or false response, or four multiple-choice answers that might be more tuned in to kid language. While this plan had merit, the QPC unanimously indicated they would no longer permit variations in the content of the four indicated answers. In other words, kids take the same exact exam as adults, and there will be no special provisions because of their young age.

"The question pool committee believes the answer and distractors used on the examination MUST remain the answer and distractors to any question regardless of the manner of presentation. With that caveat, the manner of presentation is not interpreted to be of impact to amateur radio as long as clarity of presentation is preserved," writes Ray Adams N4BAQ, Chairman, National Conference of VECs (615/688-7771).

So what can we do to get more kids into preparation for their entry-level ham test? One answer might be a specialty Novice/Technician book where questions and answers are presented in a cartoon/comic book format that would be fun and interesting for kids of all ages to read. Of course, the kids need to be motivated to get interested in studying for their ham radio ticket and getting on the air. Once they are motivated into cracking the books, *Riding the Airwaves With Alpha and Zulu* is a remarkable 275-page illustrated "comic book" that is a professionally-produced Element 2 and Element 3A training manual.

"I liked it a lot—I really got a kick out of seeing what Alpha and Zulu and all their friends were going to do next on the airwaves," comments Margaret Gibbons KE6NUL, a brand-new young ham using the Alpha and Zulu textbook.

All the characters in the book are shaped like the Morse code, giving one additional subliminal input to making Morse code fun. Even relatively dry areas like measuring mega to micro puts a smile on the face when you see characters Zulu and Juliet talking about picos, milis, and nanos. Characters Xray and Bravo have fun with Ohm's Law, and a bundled-up eskimo (E) is seen paddling over the icy (I) river (R). Ohm's Law at its entertaining best!

"What a fabulous job in presenting all of Element 2 and Element 3A materials to the young student," comments Carole Perry WB2MGP, nationally-recognized school teacher in Staten Island, New York. The book is regularly used as a reference on the "CQ All Schools" net held Tuesdays and Thursdays, 1730 hours zulu, on 28.303 or 21.303 MHz. It's a classroom hit across the country.

The text of the book was written by John Abbott K6YB, with graphics and additional materials submitted by Bill Smith N6MQS and John Mitchell. The book is published by Bill Smith's Artsci Publishing Company, best known for their professionally-prepared frequency guides, repeater map books, and radio/tech modification books. The book is sold through ham radio dealers throughout the country, and instructors may order the book in quantity from Artsci, Inc., P.O. Box 1428, Burbank CA 91507; (818) 843-4080. RF

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See The Light

A young Missouri company has announced what they say is the first fiber optic cable system for home audio and video application. Developers hope the *Mongoose* cable system will soon replace conventional wire cables carrying high-fidelity analog signals in runs of up to 2.4 miles.

Why bother? According to a company vice president, it is the best way to connect both audio and video components. "It is non-conductive, has no impedance, and neither causes nor attracts electrical noise." V.P. of Development of ASM Labs Armando Martinez forsees market demand from both amateur and professional audio and video purists. "The integrity of the original signal is uncompromised," says Martinez, adding that this is the first fiber optic system that is plug compatible with conventional equipment.

Brain Cells

Energizer Power Systems and National Semiconductor Corp. have developed a new battery that monitors its own power consumption and provides re-charging communications with the host equipment. These "smart batteries" are expected to first appear in notebook computer applications.

The new batteries use nickel-metal-hydride and nickel-cadmium rechargeable cells. The internal brains virtually prevent overcharging and allow for useful "time-left" or "% capacity remaining" information to display on the host device.

The announcement comes at a time when portable electronics equipment use is skyrocketing. Duracell International and Intel Corp. have also joined together to develop a smart battery of their own. *TNX Electronic Engineering Times, Issue 797, May 16, 1994.*

What's Your $ign?

The callsign of your dreams awaits you, and the price will be $7. That's the word from the Federal Communications Commission. On March 11, the FCC released its Notice of Proposed Rule Making to implement the new fee assessments for licensees that were authorized by the 1993 US Budget Act.

Item 59 of the NPRM notes fees for amateur "vanity" callsigns that are to take effect whenever the commission's proposal is finally approved. The current plan calls for a fee of $70, or $7 per year for the 10-year license term. *TNX Westlink Report, No. 671, April 30, 1994.*

Floating Ham Shack

Nate Brightman (top) K6OSC and Joseph F. Prevratil, president of the RMS Foundation, Inc., transmit from W6RO, aboard the Queen Mary in the historic liner's original Wireless Room. W6RO is a regular stop on the Queen Mary's self-guided tour, and welcomes any licensed amateur visiting to log in and transmit from the Long Beach, CA, landmark. For more information, please contact the Queen Mary at (310) 435-3511 or Nate Brigham K6OSC at (310) 427-5123.

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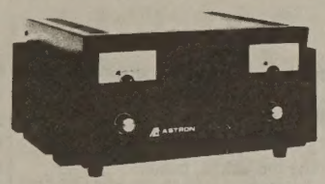

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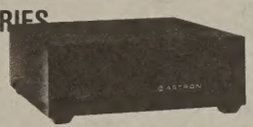


• LOW PROFILE POWER SUPPLY

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES

MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

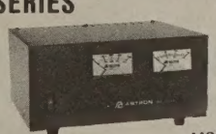
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

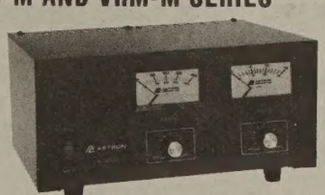
RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES



MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

RF review

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P.O. Box 6159
Portsmouth VA 23703
Telephone: (804) 484-0140
Price Class: Carolina Windom: $74.95
Carolina Windom λ/2: $74.95
Carolina Windom 160: $99.95
Carolina Beam: $99.95
Carolina Beam λ/2: $89.95

The Carolina Antenna Series

by Bill Clarke WA4BLC

The Carolina Antenna Series antennas are all based on the Windom antenna, which was originally designed by W8GZ in 1928. The Windom was a wire antenna a little over 120 feet in length, fed with a single conductor at a point far removed from the center. It required a very good station ground to be effective (and to keep RF off the mike).

The Windom design disappeared into oblivion, as have many good antenna ideas, until the 1980s, when it was modernized by Joe Wright W4UEB, Jim Wilkie WY4R, and Edgar Lambert WA4LVB. The updated design uses coax as a feedline.

The Carolina Windoms

The theory of the modernized Windom, called the Carolina Windom due to its recent Southern heritage, consists of a half-wavelength antenna (at the lowest planned frequency of operation) with an off-center feed point. The non-centered design creates a current imbalance on the feedline. As a result of this imbalance, the coaxial feedline radiates (in addition to the half-wavelength element).

In order to enhance the unbalanced condition, a dedicated matching unit is used to connect the feedline to the antenna. The feedline's radiating portion is controlled via a line isolator. The isolator prevents the entire feedline from radiating (only the portion nearest the half-wavelength element actually radiates).

The portion of the coax feedline that is between the matching unit and the line isolator acts as a vertically-polarized radiator. Therefore, the Carolina Windom produces not only the usual horizontally-polarized pattern generally associated with flat-top wire antennas, but adds a vertical component. The end result is an antenna good for local and DX contacts.

The feedline from the station to the antenna can be any high quality 50 ohm coax. My preference is RG-8X or RG-213, depending on the length of the run and the power output planned.

The Carolina Windom antennas are available in three configurations:

Carolina Windom
- Frequency coverage: 80-10 meters including the WARC bands.
- Horizontal radiator length: 132 feet.
- Vertical radiator length: 22 feet.
- Recommended minimum installation height: 35 feet.

Carolina Windom λ/2
- Frequency coverage: 40-10 meters, including the WARC bands.
- Horizontal radiator length: 66 feet.
- Vertical radiator length: 10 feet.
- Recommended minimum installation height: 30 feet.

Carolina Windom 160
- Frequency coverage: 160-10 meters including the WARC bands.
- Horizontal radiator length: 256 feet.
- Vertical radiator length: 22 feet.
- Recommended minimum installation height: 40 feet.

In general, the Carolina Windom series antennas can be mounted as flat-tops or inverted vees; however, successful installations as sloopers have also been made. It is recommended that no end be placed closer to the ground than eight feet.

The Carolina Beams

As an outgrowth of the Carolina Windoms, the Carolina Beam was developed. It is designed for the DXer; however, it operates well for those close-in 75 and 40 meter contacts.

The Carolina Beams are wire antennas based on a combination of the Windom off-center-fed antenna and the Bobtail Curtain. They are made up of a flat-top element and three vertical radiators, and will fit into smaller horizontal locations than a standard Carolina Windom antenna.

The flat-top portion of the antenna acts as a radiation counterpoise for the three vertical elements. Their radiation patterns, as with the Windom version, are a combination of vertical and horizontal components.

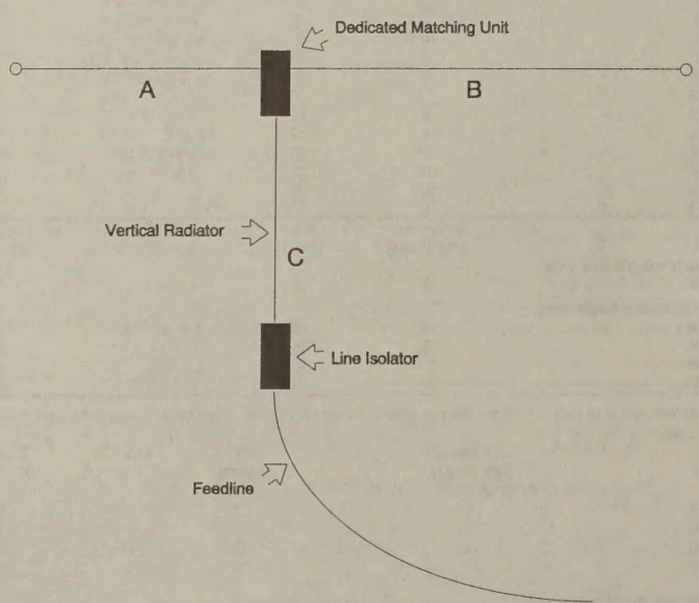
Flat-top installations are the most common. However, as with the Carolina Windom, both inverted vee and sloper configurations are possible. No end should be placed nearer to the ground than eight feet. If desired, the Beam models can be stretched out into Windom configuration (the reverse is *not* true, due to a difference in the dedicated matching unit).

Carolina Beam
- Frequency coverage: 80-10 meters, including the WARC bands.
- Horizontal radiator length: 84 feet.
- Vertical radiator lengths: 22, 16, 32 feet.
- Recommended minimum installation height: 40 feet.

Carolina Beam λ/2
- Frequency coverage: 40-10 meters including the WARC bands.
- Horizontal radiator length: 42 feet.

Continued on page 12

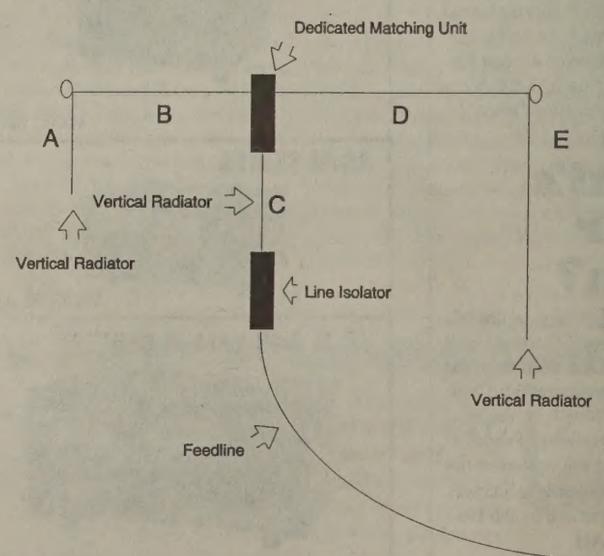
Carolina Windom



Dimensions (in feet)	A	B	C
Carolina Windom	50'	83'	22'
Carolina Windom /2	25'	41'	10'
Carolina Windom 160	81'	171'	22'

Figure 1. Carolina Windom configuration and dimensions.

Carolina Beam



Dimensions (in feet)	A	B	C	D	E
Carolina Beam	16	34	22	50	32
Carolina Beam /2	8	17	10	25	16

Figure 2. Carolina Beam configuration and dimensions.

A 222 J-Pole for Novices

A great first antenna project!

by Marty Gammel KAØNAN

This article is the result of an effort to help a mutual friend of KØUBA's and mine, a Novice named Chuck. He had never been on 220. For over a year we hunted at every hamfest for an inexpensive 220 rig to get him on VHF. We finally found a good ICOM 3AT. But he would also need an antenna. I wrote this article to help novices like Chuck.

I have made many J-poles over the last 12 years, but I never had a 220 MHz radio to experiment with before. This is an excellent first project for the Novice antenna builder; a recipe for success!

I made this antenna in less than an hour once the materials were all on hand. Tuning is a snap; it took less than 10 minutes to find the minimum SWR setting. My 222 J-pole has an SWR of less than 1.2 over the entire band. (With a little more fine-tuning I am sure you can achieve less than a 1.1 SWR, but I made this antenna during a bitter cold Minnesota winter.)

Building the 222 J-Pole

Take a look at the parts and tools list. Once all of the materials have been gathered together, you're ready to get started. Cut all of the pieces to the lengths listed in the materials list. After all of the parts have been cut, clean the areas that will be soldered. I used solvent to clean all the copper surfaces. The secret to soldering copper tubing with a propane torch is to first get the surfaces really clean.

Lay the parts out on your work table in the order that they fit together, and lay this article where you can refer to it as you assemble the parts for soldering.

Refer back to the text, figures and photos as you assemble the parts. It is a lot easier to correct an error before you solder than after. Figure 1 and Photo A should help you to visualize the assembled 222 J-Pole.

I used a paste flux, and dipped the pieces of 1/2" copper tubing right into the can.

Apply flux to one end of the 37-1/2" piece of copper tubing and place an end cap on it. Flux the other end and slide an end of the "T" onto it. Flux both ends of the base stub section and slide one end of the stub into the other end of the "T." Push the threaded 1/2" copper fitting onto the other end of the base stub.

Apply flux to both ends of the 1-1/8" crossbar piece, and insert one end into the side of the "T" and the other end into the 1/2" copper elbow. Finally, flux both ends of the 12.5" section of copper tubing and put the other end cap on one end of the 12.5" section. Insert the other end of the 12.5" section into the open end of the copper elbow.

Measure the spacing between the 12.5" section and the 37.5" section. The 1-3/16" spacing *must be equal at both the top and bottom* of the 12.5" section (see Figure 1). You may want to set a weight across these two sections to keep them in alignment when soldering (see Photo B).

Compare the assembled parts to the antenna pictured in the magazine early and often. You may want to re-measure before you fire up the propane torch.

I started at the bottom joint and worked my way up, allowing the angle of the torch's flame time to properly heat the copper tubing, without overheating. (A lot of discoloration would indicate overheating.) The end caps are the last items to be soldered. I then waited for the rest of the joints to cool down. After all soldering is completed, clean the antenna with solvent and paper towels. Remember, all flux must be removed from the surfaces.

Making the Feed Point

Take a look at Figure 2 and Photo C. I had the use of a drill press, and used both the 5/64" and 3/32" drill bits to make the elongated mounting hole shown for the SO-239 fitting. I like to use a small drill first and then the 3/32" bit. (It almost eliminates the need to file the opening.) If you have a small file, you can use it to make a better-looking opening. Solder the length of copper wire to the center terminal of the SO-239 as shown in Photo D. Mount the fitting to the 1/2" copper tubing with a stainless hose clamp. Attach the SO-239 feed point assembly with clamp to the 37.5" section of 1/2" copper tubing, also about 1-3/8" above the crossbar. Using the other clamp, mount the loose end of the wire to the 12.5" section of 1/2" copper tubing, also about 1-3/8" above the crossbar (see Figure 1 and Photo D). After attaching the completed feed point, trim off the excess wire from the clamp area.

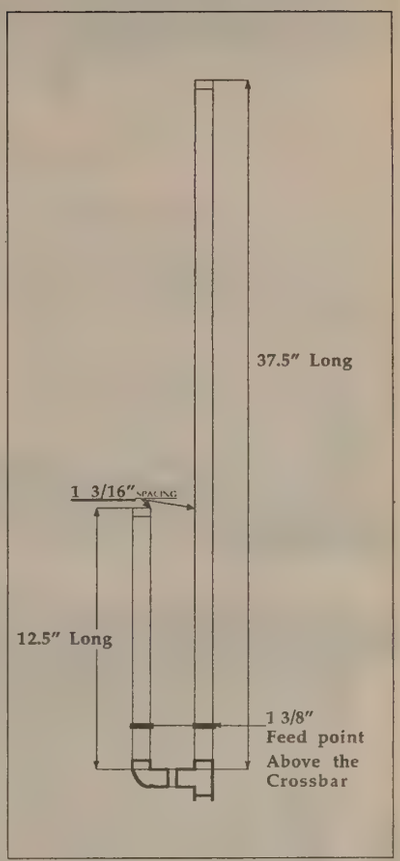


Figure 1. 222 J-Pole assembly diagram (not drawn to scale).

Tuning the Completed Antenna

I clamp the base plate to my stepladder to use as a test stand. (See Photo E.) Using a support like this will give you an easy reach to adjust the feed point for the lowest SWR, and a handy step on which to set your tools, radio, and SWR bridge. First check the SWR at the top, middle and bottom of your authorized frequency range. If you started with the 1-3/8" height above the crossbar, the lowest SWR point should be very close. Move the feed point up or down no more than 1/16" at a time, checking the SWR after each adjustment until you are satisfied with the SWR.

Final Touches

I tighten the clamps and give the antenna a final cleaning to remove all flux, dirt, and oil from handling the bare copper with my hands. Spray the entire antenna with clear exterior lacquer, varnish, or sealer to keep it looking new for years. If you want to apply a little silicone sealer to the back of the SO-239 where the wire attaches, you may do so now.

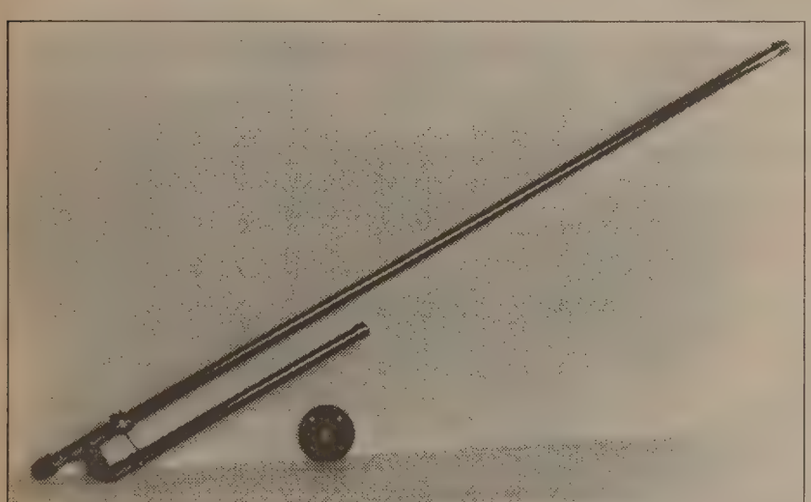


Photo A. The 222 J-Pole assembled (except for the base plate) and ready for tuning.

Photo B. You may want to set a weight across the two sections to keep them in alignment before soldering.

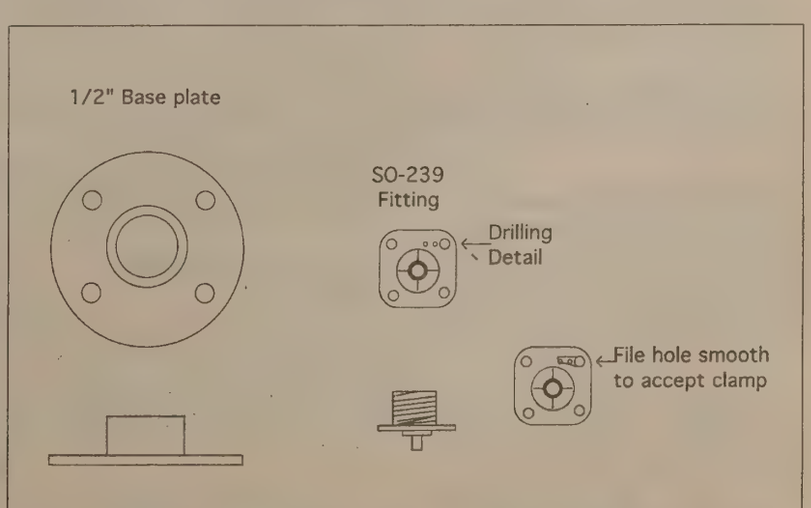


Figure 2. 222 J-pole (a) base plate, and (b) SO-239 detail.

Photo C. Note the elongated hole for attaching the clamp to the SO-239 connector.

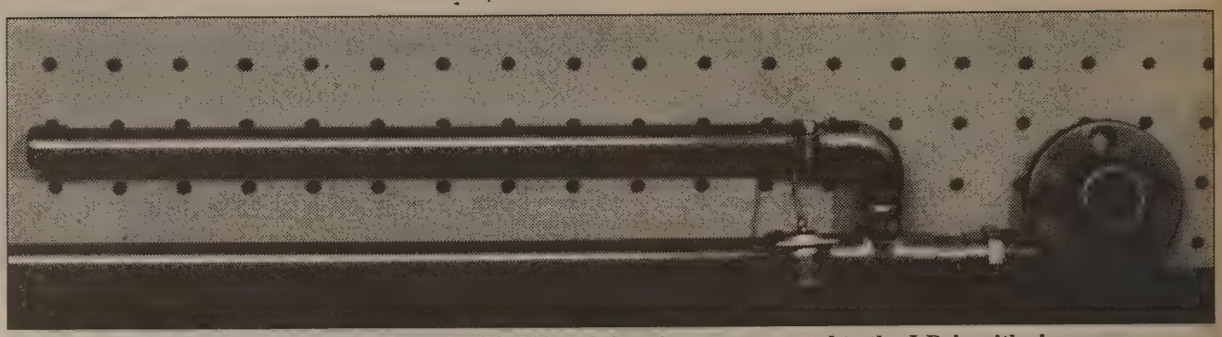


Photo D. Here you can see how the SO-239 and the wire are connected to the J-Pole with clamps.

Builder's Notes

Have the article in front of you when you are cutting parts and building the antenna. It can be more fun if you and a friend build your J-poles together, maybe as a joint or group project. Reread the article to see if you did everything right. Tune the antenna in an open area away from any wires or large solid objects that may give you false SWR readings.

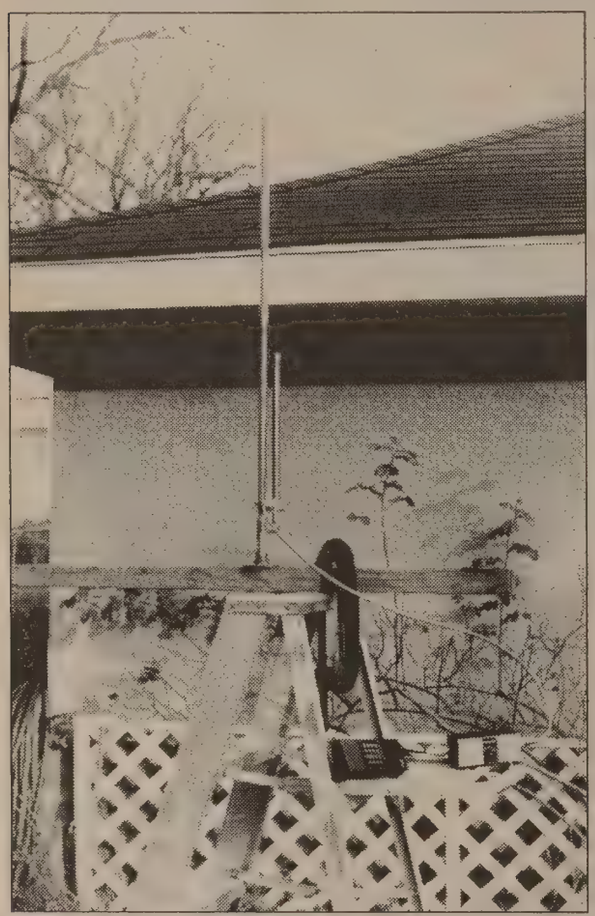


Photo E. Try a step ladder and a C-clamp for testing and adjustments.

Use an SWR meter that is accurate at 225 MHz; HF SWR bridges are not always good on VHF. Tape your coaxial connection well, and tape your feedline to your mast. Taping the coaxial feedline to the mast means that you stress the feed point less, and that the load won't vary as the wind blows.

Performance

Since building this antenna and giving it to Chuck, I have heard good reports on its performance. Chuck lives in Toledo, Ohio, where there are only three repeaters on the 220 band. So far, Chuck has made contacts on a regular basis through 47 repeaters in three states. The farthest machine is in Cleveland 110 miles away! Chuck has also made contacts on repeaters in Detroit, Jackson, and Adrian, Michigan, and he also uses repeaters in Findlay and Columbus, Ohio, along with a couple of others along the Indiana border.

This is good coverage for an ICOM 3AT with only a watt-and-a-half output. The antenna is situated on a table in Chuck's living room, and his house is constructed of metal-mesh stucco. Imagine what an outdoor installation and a little more power would do!

Many thanks to John Berglund KØUBA for his help in editing this article. Anyone with questions regarding this article may write to me and I will answer them if they send a #10 SASE with their questions to: Marty Gammel KAØNAN, 1703 Hewitt Ave., St. Paul MN 55104-1128. RF

Parts List

The first four items can be cut from a 5-foot piece of schedule M tubing.

1 piece	1/2" copper tubing 12.5" long
1 piece	1/2" copper tubing 37.5" long
1 piece	1/2" copper tubing 1 1/8" long (for the cross bar)
1 piece	1/2" copper tubing 1" to 2" long (for the base stub)
1 piece	#12 stranded copper wire 2" long
1	1/2" copper elbow
1	1/2" copper T fitting
2	1/2' copper end caps
2	3/4" stainless steel hose clamps
1	SO-239 panel mount coaxial fitting
1	1/2" copper threaded fitting (for mounting, see Photo D)
1	1/2" cast iron floor flange (for mounting)

All the above items except the SO-239 fitting can be found at a local hardware or building supply store. The SO-239 is available at any ham radio dealer or electronics store.

Tools List

Tubing cutter
Screwdriver
Electric drill and drill bit (5/64" and 3/32" for use on SO-239 fitting)
Drill press (optional)
Small hobby file (optional)
Propane torch
Solder and flux
Steel wool or Scotch-Brite pad (for brightening copper tubing)
Solvent (for cleaning up after soldering)
Clear exterior spray (for clear coating antenna after tuning)
SWR bridge capable of 225 MHz (borrow if you don't have one)

Carolina Antenns Series

Continued from page 10

Vertical radiator lengths: 10, 8, 16 feet.
Recommended minimum installation height: 30 feet.

Why a Multiband Antenna?

A single multiband antenna is ideal for many hams. It eliminates complications such as extensive towers, complex feedline switching, and great expense. Further, wire antennas are less obvious to the neighbors than towers and directional arrays.

Why a Carolina Windom Antenna?

At all frequencies above the minimum design frequency, the Carolina Windoms provide gain. This is due to the changes of radiation patterns as the ratio of radiator length to operating frequency changes. I have noted as much as 10 dB difference on received signals when comparing a Windom-based antenna to a dipole.

Although there are other multiband antennas available, I feel that the greater overall length of the Carolina antennas (23% longer) provides more capture area for better reception.

Note that it is no more difficult to install a Windom than a dipole. But, the dipole can only be operated on a single band.

Caveats for the Carolina Series Antennas

A caveat for all the off-center-fed Carolina antennas is the need for a good antenna tuner. With many of the modern XCVRs, this means a built-in tuner that automatically matches the feedline to the transmitter. A single antenna and an XCVR with an auto-tuner give instant QSY capabilities.

When supporting any off-center-fed antenna from a metal tower, be sure no vertical radiating element is closer than 15 or 20 feet to the tower. This will prevent radiation pattern degradation.

My experiences with the Carolina series of antennas includes all of the mentioned versions of flat-top configurations, and the Carolina Windom and Carolina Windom 160 in the inverted vee configuration.

I have found that the Beam series performs slightly less well than the Windom series on local 75 and 40 meter contacts. However, the Beam outperforms the Windoms on long-haul DX, due to its low-angle radiation design.

Bandwidth is very good on the entire Carolina series of antennas. I have successfully trimmed the Carolina Windom for optimum performance in the 75 meter band, with an acceptable resulting bandwidth from 3800 to 4000 kHz.

My favorite installation configuration consisted of a Carolina Windom 160 in the inverted vee format with a Carolina Beam flat-top installed at right angles to the Windom. An antenna switch selected between them. These two antennas did the work of an entire antenna farm, allowing consistently good DX contacts as well as local 75 and 40 meter operations.

SWLs Use the Carolina Antennas

Due to the all-band coverage of the Carolina series of antennas, they are perfect for the SWL. Because of its small size (only 42 feet overall length), the Carolina Beam λ/2 is the recommended choice. The λ/2 provides gain above 41 meters and performs well on the 60 and 49 meter bands. It is excellent for the 25, 19, 16, and 13 meter bands.

Availability and Price

The Carolina series of antennas are available from The Radio Works, P.O. Box 6159, Portsmouth VA 23703; telephone: (804) 484-0140. The prices are: Carolina Windom $74.95; Carolina Windom λ/2 $74.95; Carolina Windom 160 $99.95; Carolina Beam $99.95; and Carolina Beam λ/2 $89.95. The Radio Works display can be seen at most Eastern and Southeastern hamfests. RF

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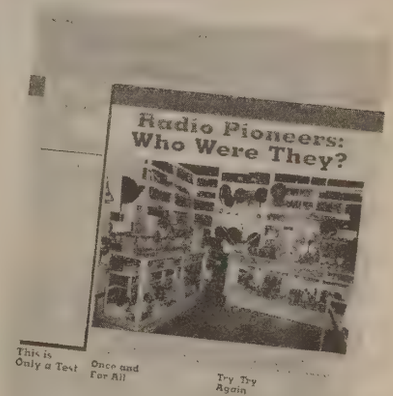

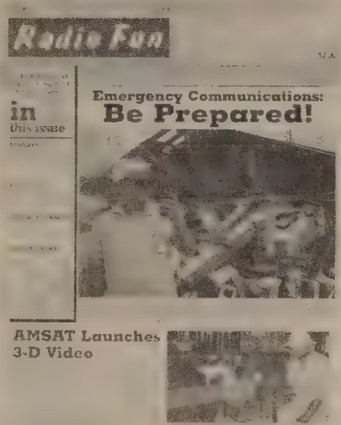

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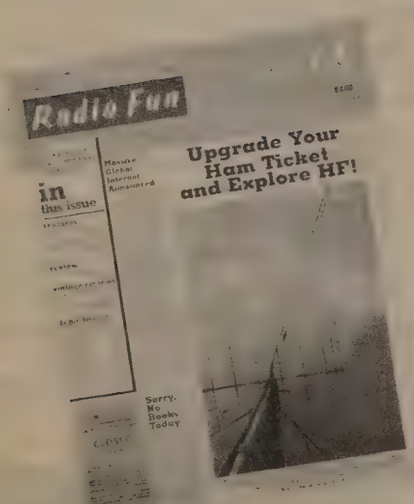

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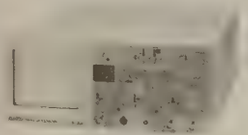

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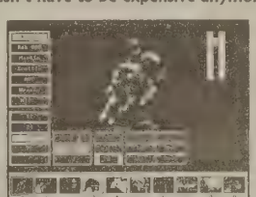

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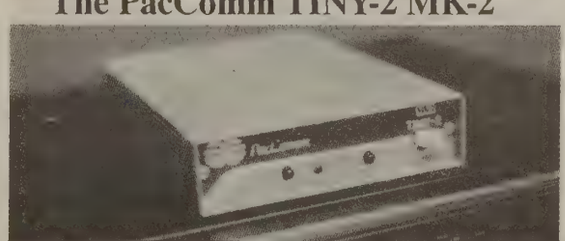

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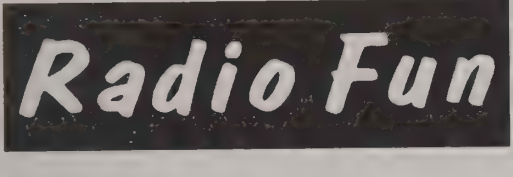

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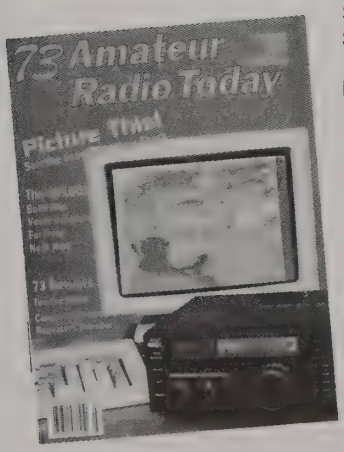

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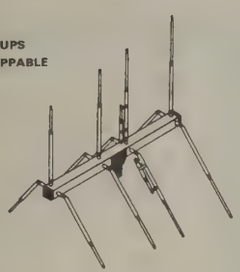

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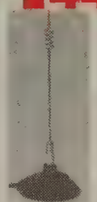

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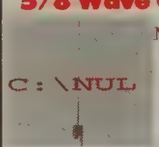

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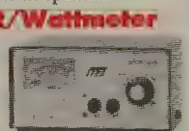

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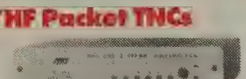

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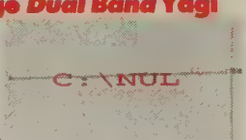

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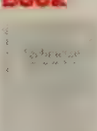

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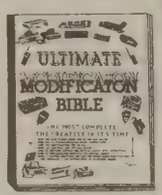

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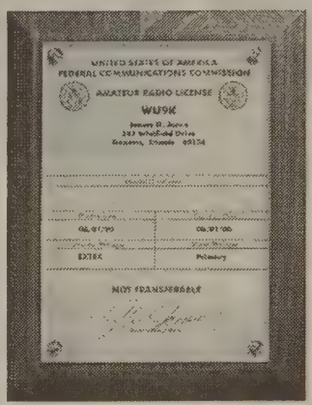

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2 Meter Single Sideband Operation

Take your VHF hobby to the next level!

by George Brown WB4CHZ

All across the country there are hams who are not getting full value from their radios or their hobby. In fact, many of these amateurs are probably using less than half of their rig's capability. Are you one of these people?

Take this simple test. Just answer these four "Yes" or "No" questions:

1. Do you own a multimode 2 meter transceiver?
2. Have you operated a mode other than FM on 2 meters?
3. Do you know where to listen for 2 meter SSB activity?
4. Have you made a 2 meter DX contact on SSB or CW?

If you cannot answer yes to all of these questions, you are not getting the most out of your rig or your hobby. Read on and discover the world of 2 meter SSB.

Where to Listen

On the FM portion of the band, operators on 2 meters are scattered all over the place. Not so with SSB. In fact, most can be found monitoring a single frequency, 144.200 MHz. The reason for this is simple. Since the SSB/CW part of the 2 meter band is a large chunk, and since the number of multimode ops is comparatively low, it is important that everyone start out on the same frequency. Once contact is made, it is considered good manners to move off the 144.200 MHz call frequency so that others can monitor or put out calls.

To make a 2m SSB contact, select the proper mode on your transceiver and tune to 144.200. Now, if you normally use an FM-only amplifier, make certain it is turned off, since it will distort your SSB signal and put you in violation of FCC rules. After listening for any activity, and finding none, all that is left to do is call "CQ."

You may be saying to yourself that no one calls "CQ" on 2m. This *is* the case on the FM portion of the band, but calling "CQ" is common practice on SSB. Don't be discouraged if you do not immediately receive a response to your all-call. Remember that you have had a multimode rig for some time and have rarely, if ever, attempted to make an SSB contact. There are probably many others in the same position, and they may not necessarily be listening when you decide to call.

If, after repeatedly calling "CQ," you still have received no response, go back to the FM portion of the band, but don't give up. Listen around and find someone you know with a multimode rig. Ask them to switch frequencies and meet you on 144.200 SSB. To your amazement, others who are listening will probably follow.

Once you get a few people on SSB, it is up to you to make yourself available for contacts. After all, you didn't enjoy calling "CQ" without getting a response, and the people you have drawn down to the lower end of the band won't either. If your area is like most, these new SSB ops will soon discover that this "new" mode is a lot of fun, but they too will have a lot to learn.

Equipment Needs for 2m SSB

Depending upon who you ask or what you read, there is really no limit to the number of opinions you will get regarding equipment for 2m SSB. Over the years I have heard it all. When I was just starting out in amateur radio in the mid-1970s, one "veteran" ham told me I was wasting my time "fooling with" 2m. He explained to me that I would need a kilowatt and large beam antenna to talk to anyone outside of the Memphis area.

Needless to say, this was discouraging, but fortunately other hams who were more experienced in VHF work encouraged me to give 2m SSB a try. Please understand that the veteran amateur was not trying to mislead me—he honestly believed that VHF was limited to local contacts and that to make contacts more than a few miles away you should go to HF.

The simple fact is that 2m multimode work does not require much more than 2m FM. The main difference is that some sort of beam antenna is necessary for SSB, whereas a vertical is usually sufficient for FM. On the other hand, the beam does not have to constitute a major financial investment. In fact, by going with a simple quad antenna, it is possible to home-brew an excellent performer for virtually no out-of-pocket expense.

If a quad is not to your liking, or if a yagi design makes you happier, this type can also be built at home for minimal expenditure. For more information on antenna construction, have a look at back issues of *73 Amateur Radio Today*. Over the years there have been numerous straightforward articles on building VHF antennas.

Finally, if you simply hate the idea of building a project, every major antenna manufacturer offers yagis for 2m SSB. My recommendation is to get at least an 8-element beam. This will not be too long, and it will not create a major load problem for even a small TV-type rotator; however, it will provide adequate gain for many of your SSB contacts.

> ***"2m multimode work does not require much more than 2m FM. The main difference is that some sort of beam antenna is necessary for SSB, whereas a vertical is usually sufficient for FM."***

The important thing to remember about an antenna for 2m multimode is that it really should be horizontally polarized. On the other hand, if you are currently using a vertically-polarized beam for FM, do not be afraid to use it. While it is true that, according to theory, you will lose about 3 dB of gain when communicating with a horizontally-polarized station, this is not always a serious problem. In fact, many of the stations I have contacted over the years were equipped with a vertically-polarized beam.

Another rumor you might hear is that the antenna you use for FM should not be used at the lower end of the band, since the SWR might be too high. This might be true if you are using a specially designed, extremely high-gain beam on FM, but for the typical installation this argument is nonsense. While it is true that you may not have an optimum setup with a vertically polarized FM beam antenna, the fact is you can make many enjoyable SSB contacts with no additional expense or installation effort.

How Much Power

As with antenna requirements, a beginner to multimode 2m can hear a multitude of opinions regarding power requirements. The question of power is actually rather easy to answer.

If your interest is in reliable communications within 50 to 75 miles of your station, and if you have a good 8-element or better antenna at least 10 meters above the ground, you really need only about 25 watts or so of output power. Since most of today's rigs have outputs in this range, no external amplifier is necessary. In fact, with a station such as this, a lot of VHF DX can be worked during favorable band conditions.

With the addition of a 100 to 150 watt amplifier, your 2m station moves to a new level. At this power level, assuming you have a modern, hot receiver section, contacts out to 100 to 150 miles with similarly equipped stations are commonplace. In addition, this power level allows marginal band openings to be exploited and opens the door to meteor scatter contacts, one of the most exotic VHF modes.

Extremely high power, 1 kW or so, is necessary on 2m only for highly specialized communication modes. Among these modes are 2m backscatter and moonbounce. In addition to the power levels needed, large high-gain antennas are also a virtual necessity for these difficult forms of propagation.

What Can Be Worked and When

Fortunately, many long-distance 2m contacts are possible with the more modest stations described above. From Memphis, using a 14-element beam at 10 meters above local terrain and 25 watts output, I have worked stations in New Mexico, North Dakota, Iowa, Michigan, New York, and Minnesota. However, realize that you are not going to do this on a nightly basis; rather, you must wait for favorable band conditions.

Generally speaking, there are two modes of 2m long-distance propagation that a typical amateur is likely to utilize. By far, the rarest mode is sporadic E "skip." An "E" opening can occur at times of high solar activity when the E-layer of the ionosphere is disturbed by intense radiation (see Figure 1).

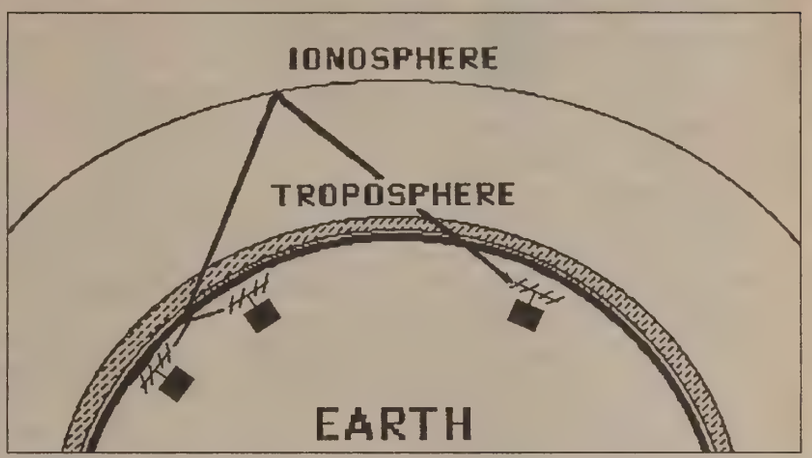

Figure 1. Moderate-distance 2m openings are the result of tropospheric enhancement, while long-distance contacts are usually the result of meteor scatter or sporadic E, both of which occur in the ionosphere.

When this happens, patches of the E-layer can become reflective to 2m waves and cause signals to bounce over long distances. In fact, contacts over 1,000 miles or more are possible with even modest equipment during a strong sporadic E opening. Unfortunately, such events are very rare on frequencies as high as 144 MHz. In addition, solar activity is currently very low and will remain so for several years. Thus, the likelihood of a good 2m "E" opening in the near future is slim.

The most common propagation mode on 2m is "tropo," which is short for tropospheric. Tropo openings do not usually provide DX contacts as far away as sporadic E, but they are, nonetheless, just as exciting. During one memorable opening from Memphis, stations were heard almost simultaneously from the Midwestern U.S. and New England.

The question is: When do enhanced band conditions like this occur? Fortunately, there are some signs you can look for which indicate a possible tropo opening. One of the best indicators is fog! Since the troposphere is where weather takes place, it has long been suspected that tropo openings are related to temperature inversions.

An inversion occurs when the temperature over a particular site does not drop with altitude. Under normal conditions, the cooling rate for dry air is 10 degrees C/km; however, during an inversion, the temperature above a certain point will rise, and fog will usually form.

Thus, if the weather turns foggy, your 2m multimode should turn on. With a little listening around and calling of "CQ," there is no telling who may show up on your frequency.

Conclusion

Now that you know about 2m SSB, do something with this knowledge. Go to 144.200 and call "CQ." If no one is there, go to FM and drag someone down the band! When you get people on SSB, talk to them; no one likes to hear dead air. 2m is a fine band, and many great contacts can be made there; just make sure you take advantage of the entire band and all modes of your multimode rig. RF

the tech side

by Michael Jay Geier KB1UM

What Is That Thing?

Since you're reading this column, I guess I can safely assume you have an interest in the innards of your ham gear. At least, I hope so. If you're new to this game, you may have taken a look inside one of your radios and become scared off. Heck, none of us want to damage expensive equipment or get hurt! At the same time, though, the only way to learn how to fix and modify your gear is to get inside and learn. Can you learn safely, without risk to yourself and your radios?

Yes! There is absolutely *no excuse* for hurting yourself in this hobby. It has happened, but it just about always involved negligence on the part of the experimenter. As for damaging the equipment . . . well, even seasoned pros do it now and then, but it's pretty avoidable. The key to happy troubleshooting is *knowledge*. Really knowing today's complex electronics is an ongoing process, because the technology changes so fast. And, there's a great deal to learn. But, you gotta start somewhere, and a good place to begin is with the identification of all those parts in there. Not only are there many different kinds of components, such as transistors, ICs, capacitors, crystals, and so on, but each category also has lots of different-looking members, making the task even more confusing. So, let's take a look at the kinds of parts you're likely to run into, where you'll find them, what they look like, and how to tell one from the other.

On Board

Before we get to the actual parts themselves, let's examine the callout letters used to represent those parts. There's a good reason for doing this: Many PC (printed circuit) boards have the letters printed next to the components, and knowing what they mean can really go a long way toward helping you to identify a mysterious part. In fact, a few different kinds of parts look so similar that sometimes the only way to be sure is from the letter on the board, which makes for a frustrating experience when the board has no letters on it. Luckily, most late-model Japanese gear include them. Here are the most common callouts:

Q - transistor
R - resistor
C - capacitor
L - coil (inductor)
T - transformer
D - diode
IC - integrated circuit (chip)
X - crystal
F - fuse
VR - variable (adjustable) resistor
TC - trimmer (adjustable) capacitor

Now, let's examine each category in greater detail, so you'll know what the parts actually look like.

Q (transistors): They come in many shapes and sizes. Many small-signal (non-power-handling) transistors are made of black plastic. Some are metal. The plastic ones are often upright, with one flattened side and the leads coming out the bottom. The metal ones are usually round, with a little tab on one side. The giveaway is that transistors have three leads, which is very unusual with any other kind of part.

Power transistors can be flat, black plastic with a metal tab sticking up. They also can be round metal cans, with flanges on either side. Those can seem deceptive because they only appear to have two leads, but they really have three connections, the metal case providing the third. That style of case is nearly always found attached to a big metal heat sink. The flat, upright kind are also used with heat sinks, but you may find them sticking up from a board, with no heat sink attached. No matter what the case style, power transistors are much bigger than small-signal types.

> ***"Not only are there many different kinds of components, such as transistors, ICs, capacitors, crystals, and so on, but each category also has lots of different-looking members, making the task even more confusing."***

Transistors come with all kinds of numbers on them, but some are common enough that they're worth remembering. Anything that starts with 2N, 2SA, 2SB, 2SC or 2SD is a transistor. An example: 2SC924. But beware: Many Japanese parts omit the 2S designation, so that part may read C924. It's just a 2SC924 in disguise.

FETs (field-effect transistors) have their own number system, with many starting with a 3. Examples: 3SK45 and 3N211. Some FETs are of the MOSFET variety, and those may have four leads instead of the usual three. And, the numbers may be quite odd. That 3N211 is a MOSFET, and so is a 40673.

American parts often have 2N numbers. Some very common ones: 2N3904 and 2N3906. European parts, which are not as commonly found in this country as the Japanese ones, use their own number system, even though many of them can be cross-referenced to the Japanese system. You might see BY, BUY and other odd prefixes. Generally, if it looks like a transistor and the number makes no sense, it probably is a transistor with an odd number, rather than another kind of part.

Speaking of other kinds of parts, there is one which often confuses new troubleshooters because it looks like a transistor but isn't. I'm talking about the three-terminal voltage regulator. These things are very popular, and they use the same case styles as transistors. Be on the lookout for numbers like 7805, 7812, 7905, 7912, LM340T5, LM340T12, 78L05 and so on. As you may have guessed, the final numbers indicate the output voltage: an LM340T5 puts out 5 volts. If there's an M or L in the middle, it indicates medium or low current capability. The L parts look like small, plastic transistors, while the M and higher parts look like flat plastic power transistors with metal tabs. Oh yeah, let's not forget the LM317, which is a popular adjustable regulator that comes in both the large metal can and flat plastic styles.

R (resistors): These are a lot easier to identify than transistors. They have small, hot-dog-shaped bodies with a lead at each end. The giveaway here is the series of color bands, which is a code that tells the value of the resistor. Why color bands instead of printed numbers? The system dates from the vacuum tube days, when resistors often got so hot that normal numbers printed on them would burn off. Manufacturers switched to the more durable color bands, and even with today's low-power, no-heat circuits, the system has stuck. Reading the bands is not hard, though. Usually, there are four bands. One of the ends will be gold or silver. That one specifies the tolerance, or amount the resistor can deviate from its stated value. Silver denotes 10% tolerance, while gold is 5%. Most resistors today have a gold band. The other three bands are read as follows: The first two, read from the point farthest away from the tolerance band, give the basic value, and the one closest to the gold or silver is a multiplier, which is just a fancy way of saying it specifies how many zeros to add at the end of the value. Here's the "secret" code:

Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

Let's say you find a resistor with the following color bands: brown, black, red, gold. What value is it? Well, brown is 1, black is 0, red is 2 and gold means 5% tolerance. The key here is that red band. It's the multiplier, and it specifies two zeros. So, we have 1,0,00. That's 1000 ohms, also known as 1k ohms. It's as simple as that!

Sometimes you come across a resistor with five color bands. That's a high-precision resistor, typically with a 1% or 0.5% tolerance. You read it the same way, except that there are three value numbers before the multiplier. So, a 1k ohm resistor would read: brown, black, black, brown and then the tolerance band. That's 1,0,0 and one 0. By the way, never replace such a resistor with a common 5% part, because the manufacturer used the more expensive, precise one for a reason. If you do try it, expect the circuit's performance to be compromised in some way.

Well, there's lots more to cover, but I've run out of room. So, until we continue this next time, 73 from KB1UM. RF

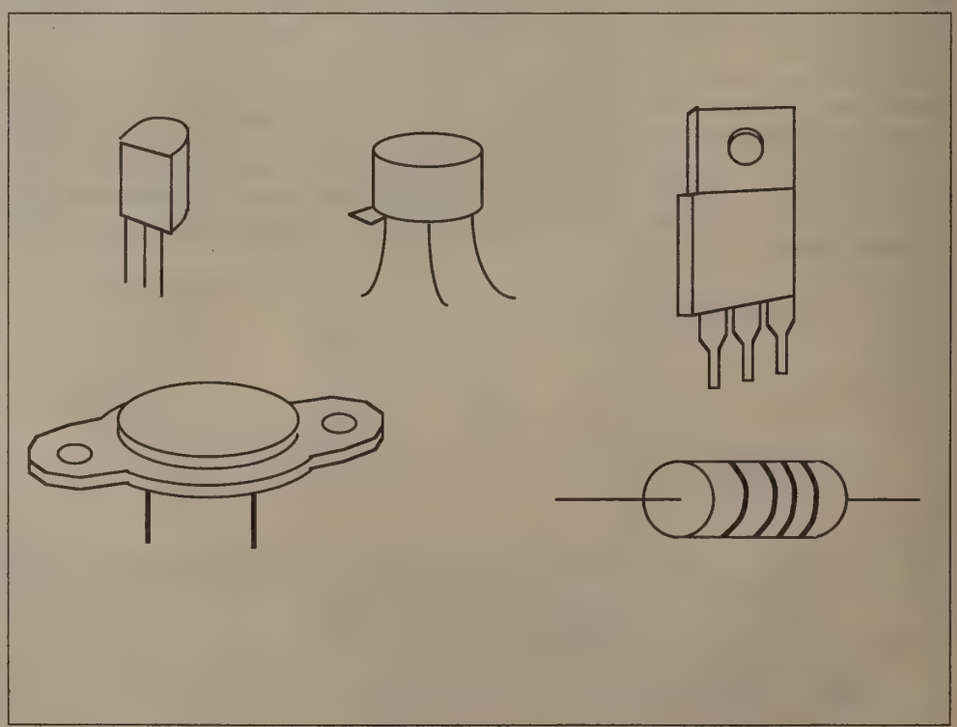

Figure 1. Some typical transistors and (lower right) a typical resistor.

radio magic

by Michael Bryce WB8VGE

Direct Conversion Receivers

For the past few months I've been explaining the internal workings of the superhet receiver. This month we'll look into a different type of receiver. It's called the direct conversion (DC) receiver. This type of receiver has gained a lot of respect in the last several years, due mostly to the introduction of the NE602 mixer chip and several new designs in audio chips.

There's something kinda magical about listening to signals on a direct conversion receiver. They *jump* out of an almost noiseless background. But it's not a receiver for everyone, either. There are a lot of *quirks* to the design.

What is Direct Conversion?

Again, we'll start with the input to the receiver. And again, the signals from the antenna pass through several tuned stages. The tuned *front end* helps provide selectivity before any signals reach the mixer. Generally, on frequencies below 20 meters (14.0 MHz) there will be no need for an RF amplifier after the tuned circuit.

After the signals from the antenna pass though the tuned circuit they go directly to the input of the mixer. In a direct conversion receiver, the mixer may be either passive, meaning it requires no operating power, or the mixer may be active. An active mixer does require power to operate and usually provides some gain in the mixing process. On the other hand, a passive mixer will not supply any gain. In fact, most passive mixer designs will actually cause some loss in gain. A very popular type of passive mixer is the double-balanced mixer. Here several toroid cores are specially wound to couple the RF energy from the antenna with the VBFO. A set of matched diodes rounds out the passive mixer. An active mixer, such as the NE602 or the MG1494, provides a slight amount of gain, but introduces critters (noise, intermodulation distortion and so on) on the desired signal.

When the signals from the antenna pass though to the mixer they are mixed with VBFO in just the same way as in the superhet receiver, but with a slight variation. In the case of the superhet receiver the VFO is operating at a different frequency than the receive frequency. In the direct conversion receiver the VFO operates at the same frequency of the desired signal. In the direct conversion receiver the VFO, or Variable Frequency Oscillator, takes on a new name—the VFBO or Variable Frequency Beat Oscillator. Why? Because the VFBO is running at the same frequency as the desired signal it mixes (or heterodynes) with, which is the incoming signal, thereby producing an *audio* signal. Thus the name direct conversion. The RF signal is mixed and the result is audio. The signal has been converted directly to an audio signal in one step!

Just as the superhet produces an output from the mixer that is the sum and the difference, so does the direct conversion receiver. But, with a new twist! The sum and the difference from the mixer are equally useful and it's almost impossible to get rid of the undesired signal.

OK, I lied on the last sentence. You can eliminate the unwanted signal but it's not easy to do. In fact, by the time you eliminate it, you have exceeded the complexity of the superhet receiver. For what it's worth, you need to put the unwanted signal 180 degrees out of phase with the one you want. It's much easier said than done!

Here's an example to clear things up. If your VFBO is running at 3737.0 kHz and you tune in a station operating at 3737.0 kHz, you'll hear nothing but a zero beat sound in the speaker. That's because both frequencies are exactly the same. They produce no *tone* in the speaker. Now, move the VFBO so it's running at 3737.6 kHz and you'll hear a 600 Hz tone in the speaker. You're sitting 600 Hz higher than the signal you want and so the receiver produces a beat tone. You can now hear the code coming in. But . . . the mixer also produces a tone at 600 Hz *lower* (3737.4 kHz). So, you'll hear *two* identical signals in a direct conversion receiver. This particular oddity must be taken into account when trying to work the other station. If you tune on the wrong side of zero beat (while operating a direct conversion transceiver) the station calling "CQ" will never hear you. This is because most modern transceivers will shift their transmitters down slightly in frequency, normally about 800 Hz. If you tune in the other station on the wrong side of zero beat, he'll never hear your signal.

Because the VFBO operates at the same frequency as the band you wish to receive, careful design must be used to keep the VFBO stable. In fact, you'll not see too many direct conversion receivers running *straight through* above 20 meters (14 MHz) because it's very hard to keep the oscillator stable at those frequencies. Instead, a mixing scheme is generally used. As in the superhet receiver, our VFO would operate at a much lower frequency (to improve stability) and then be mixed with a second oscillator to produce the desired VFBO frequency. This is the exact method used by Ten-Tec in their Century 21 and Century 22 CW transceivers.

Another popular method is to operate the VFO at a lower frequency and then use a frequency doubler. A VFO running at 5.5 MHz and then doubled would be ideal for a 30 meter direct conversion receiver!

Since the output from the mixer is audio, there are no IF filters to provide selectivity. Instead, all the selectivity for a direct conversion receiver (aside from the tuned circuits in the front end) must be done at audio frequencies. Again, as with the mixer, we can use either a passive or active audio filter.

Because there is no IF filter and therefore no IF amplifier, all the gain of the direct conversion receiver (other than any the active mixer may generate) must be done also at audio frequencies. It's not unusual to have 100 dB worth of gain in the audio section of a direct conversion receiver. With gain this high at audio frequencies, it's hard to keep the audio sections of the receiver tame. Heavy decoupling of the audio stages is a must. Careful layout of the circuit board is another factor in keeping the audio stages tame.

With all this gain in the audio section of the direct conversion receiver, you can easily end up with a condition known as microphonics. When you have the audio chain amplifying signals with a gain exceeding 100 dB, any (and I mean *any*) mechanical movement will be picked up and amplified out to the speaker or headphones. An ant's footsteps walking across your operating table three feet away can clearly be heard in a badly designed direct conversion receiver. Connect an external speaker to the above receiver and you'll have a very fancy noisemaker. The speaker will cause the receiver to howl and squeal from the feedback of the audio circuits hearing the speaker. It's like getting the microphone too close to the speaker in a PA setup at church.

Because of the problems with the high audio gain, most, but not all direct conversion receivers work best on a battery and headphones. Using a 110 VAC power supply can cause a problem known as "common mode hum." Here the AC (from the power supply's transformer) gets into the the VFBO and mixes with the audio chain. The process oscillates and you end up with a very nasty (and often very loud) 120 Hz buzz in your headphones. There are filters you can add to the output of your power supply to help eliminate this problem, but most people just use a battery supply instead.

No BFO

Because the output from the mixer is audio, there is no need to mix the signals with a BFO to produce an audio signal. Since there is no BFO, you can select either LSB or USB by tuning to either side of zero beat for LSB or USB reception.

AGC Control with a Direct Conversion Receiver

Since the gain of the direct receiver is in the audio stages, the automatic gain control, or AGC, must be audio-derived. The resulting DC voltage is usually applied to one or more stages of audio preamplifiers to control the receiver's gain. In some more elaborate circuits, the AGC voltage may also control an RF amplifier in the front end of the receiver. In the case of most home-brew designs, you'll not see this feature.

A single audio power amplifier chip is usually used to drive either headphones or a speaker. The popular LM386 audio amplifier produces up to 500 milliwatts of audio. It's normally rather stable and it's available right off the pegboard at your local Radio Shack. Another popular audio amplifier chip is the LM380. The chip will produce up to 1 watt of audio into an 8 ohm load.

If the direct conversion receiver has all these faults, why build one in the first place? Well, they're very easy to build and get working. You don't need to worry about getting the IF tuned to the correct frequency, and you don't need hand-selected crystal filters either. The newer DSP chips allow unequaled selectivity at audio frequencies.

You can mate a small QRP transmitter directly to the direct conversion receiver quite easily. Since the VFBO is operating at the same frequency you're listening to, all you need to do is add a buffer or two between the VFBO and the first stage of your transmitter. Voilà! You now have a transceiver.

There is very little receiver noise in a well-designed direct conversion receiver. Signals really do seem to pop out of a noiseless background. There's a clarity to the received signals that is kinda hard to explain. There's a crispness and body to the CW or SSB that's lost in the super-filtered and ultra-mixed superhet receiver we use today.

Down the road, if there is enough interest, we'll put a direct conversion receiver together. Then you'll be able to explain the magic to someone else, because of your hands-on experience! RF

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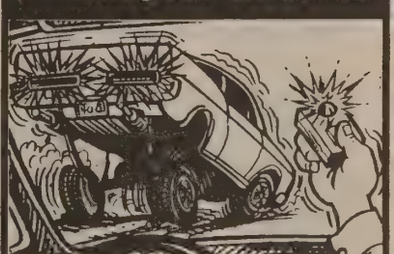

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antennas, etc.

by Joseph J. Carr K4IPV

Making the Connection to Wire Antennas

Wire antennas have a certain appeal for me because most of them work rather well, are easy to build, and are usually quite cheap compared with verticals, beams and others. Most hams operating in the HF region have probably installed some form of wire antenna for their first attempt to get on the air. This column will take a look at how to make the electrical connections to wire antennas. For our example we will turn to the most popular wire transmitting and receiving antenna, the dipole.

The dipole is a half-wavelength piece of wire that is fed in the center (Figure 1). In most cases, the wire should be #14 or #12 Copperweld or hard-drawn copper wire. If it's marked "antenna wire" and is from a reputable source, then it's probably a reasonable choice.

Because the feed point is a current node, the impedance is low so that it makes a good match to coaxial cable. Although the usual case is to use 75 ohm coax, and that is usually a good selection, the actual feed point impedance of a dipole is dependent on the height above ground. It will vary above and below 75 ohms by about 50 percent or so.

The ends of the dipole are usually supported by ropes and end insulators. The center of the dipole is usually supported by either a center insulator or a 1:1 balun transformer that is mechanically designed to be used at the feed point of a dipole. It is good advice to use the balun, by the way. Although it was once "a matter of opinion" and a bit controversial, antenna azimuthal polar patterns reproduced in at least one edition of *The ARRL Antenna Book* convince me that the balun results in a better, more nearly "figure-8" radiation pattern. For purposes of making the mechanical connections, however, center insulators and baluns are essentially the same, so I'll use center insulators for my examples (I had the photos on hand).

Photos A and B show two forms of center insulator. In the version shown in Photo A, an SO-239 coaxial cable connector is used for the transmission line to the rig. The two quarter wavelength wire elements are connected to the insulator by way of two electrical lug connectors fastened to the body of the insulator by way of eyelet screws. The eyelet screws are used for strain relief of the the wire. The wire is passed through the eye, and then turned back on itself seven or eight times (more of that in a moment).

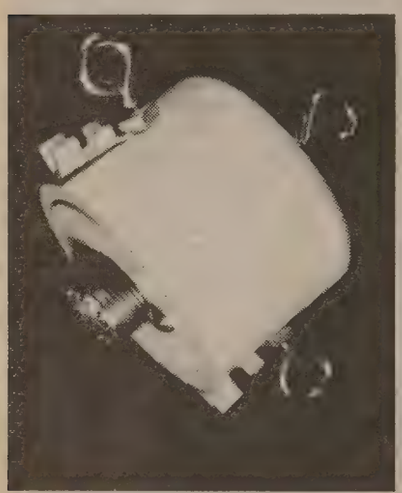

Photo A. Center insulator for dipole.

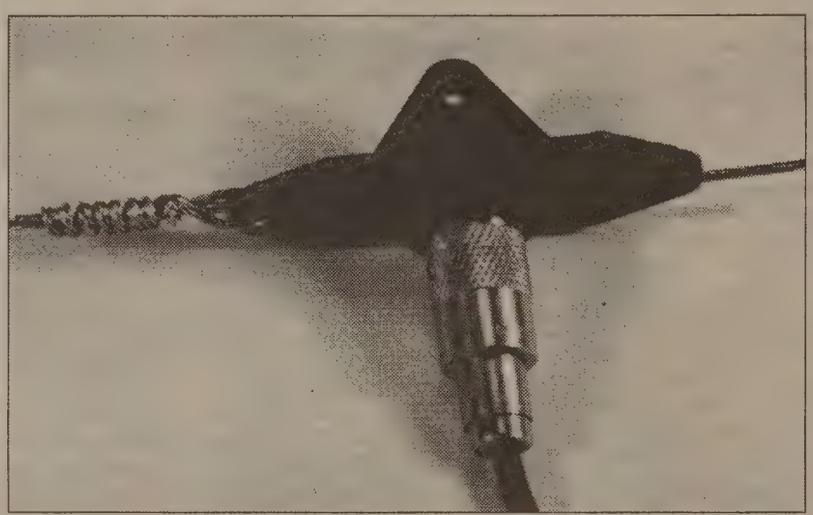

Photo B. Alternate form of center insulator.

Photo B shows an alternate form of center insulator. In this case, strain relief holes are at either end of the flat plastic piece. Electrical connections are made to a heavy-gauge piece of wire. The antenna wire is passed through the hole, and then wrapped back on itself seven or eight times, covering the connection wire.

In both cases (Photos A and B) the wire end wrapped back on the radiator wire is intended for strength. To ensure the electrical integrity of the connection, it is common practice to tin the splice joint with solder. Use either 50/50 or 60/40 lead/tin rosin core solder. Use only radio or electronic solder—do *not* use acid core solder, plumber's solder, or anything but rosin core solder in the 50/50 or 60/40 mixtures. The purpose of the solder is not to provide mechanical strength (that's the purpose of

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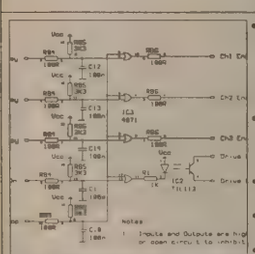

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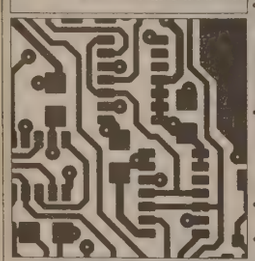

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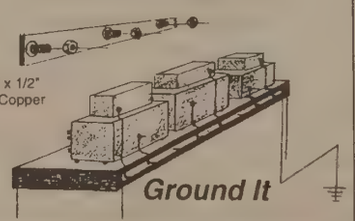

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wrapping the wire back on itself), but rather to keep the electrical connections tight.

Both Photos A and B have an eye at the top of the center insulator. In Photo A it is an eyehook, while in Photo B it is a hole in the body of the piece itself. Both are used for similar purposes. In some cases, the center of the dipole can be supported by a rope from a mast, tree limb, etc. This is especially likely in the case of the "inverted-vee dipole" antenna in which the center is mounted and the ends drooped towards the ground. Another use is to strain-relieve the coaxial cable. There is a stress on the coax and the connector, and that stress leads to premature failure of the connection. Some people make a 6-to-12-inch loop of the coax and tie with twine to the eyelet in such a manner that the stress is removed from the connector.

Photos C (a) and C (b) show a collection of wire antenna end insulators. The form shown in Photo C (a) is a nylon version of the classic end insulator. In "olden days" (i.e. when I was a KN4) these insulators were typically made of either glass or ceramic material. Although a number of different forms were sold (and are still available from many sources, especially at hamfests), all bear a striking resemblance to Photo C (a). In all cases, however, there will be a pair of holes, one in either end. One hole is for the antenna wire, and the other is for the support rope.

Modern forms of end insulator are shown in Photo C (b). Both of these insulators are made of a black synthetic material, and are designed to increase the electrical length over the mechanical length by using a ribbed design. In both cases, however, there are a pair of holes (one at either end), just like the classical form shown in Photo C (a). It is generally considered best to use the longer of these insulators, although in practical terms, for most ham uses, I've never noted any real difference between any of the three types.

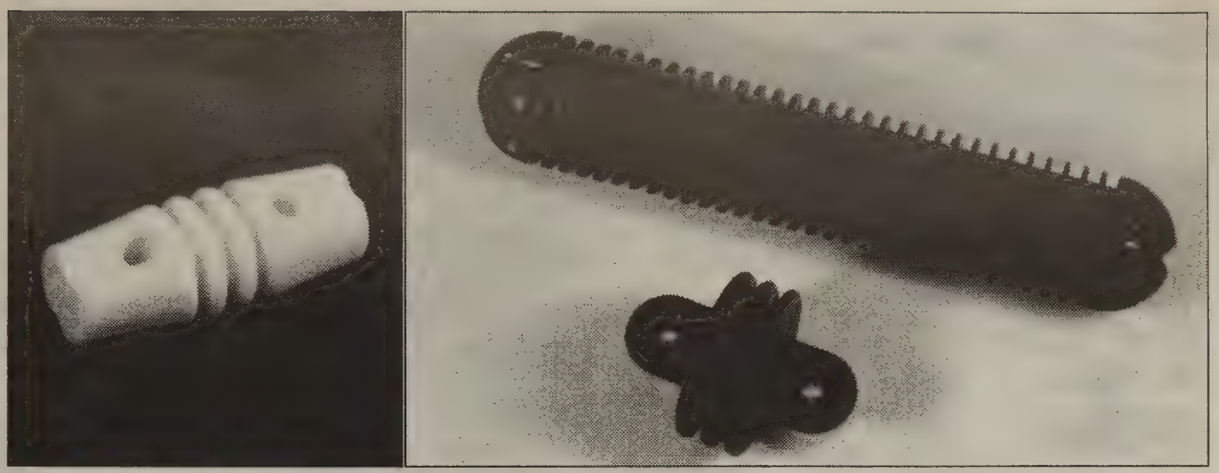


Photo C. a) Classic end insulator; b) Modern end insulators.

Photo D shows the connection to the end insulator. As in the case of the center insulator, the wire is passed through the hole in the insulator, with 6 to 8 inches of free wire. The wire is then wrapped back on itself about seven or eight times to make a tight mechanical and electrical bond. Any loose ends (Photo D) should be cut off. As mentioned above, tin the joint with solder to prevent weather corrosion from eroding the electrical connection.

Wire antennas will deteriorate over time. I recommend an annual examination of the antenna connections. Look for frayed wires, and cracked or cruddy looking solder joints. If necessary, redo connections.

Photo D. Connection to end insulator.

Supplies for Wire Antenna Construction

Supplies for wire antennas can be bought from nearly all ham radio suppliers, and through the advertisements in this magazine. Also, most hamfests of any size will have one or more wire antenna supplies tables in the commercial area . . . not to mention the miscellaneous supplies in the tailgating area. Sometimes I buy supplies for my projects from The Radio Works [Box 6159, Portsmouth VA 23703; 804-484-0140 (voice) and 804-483-1873 (FAX)]. They publish a wire antenna catalog that contains some interesting products.

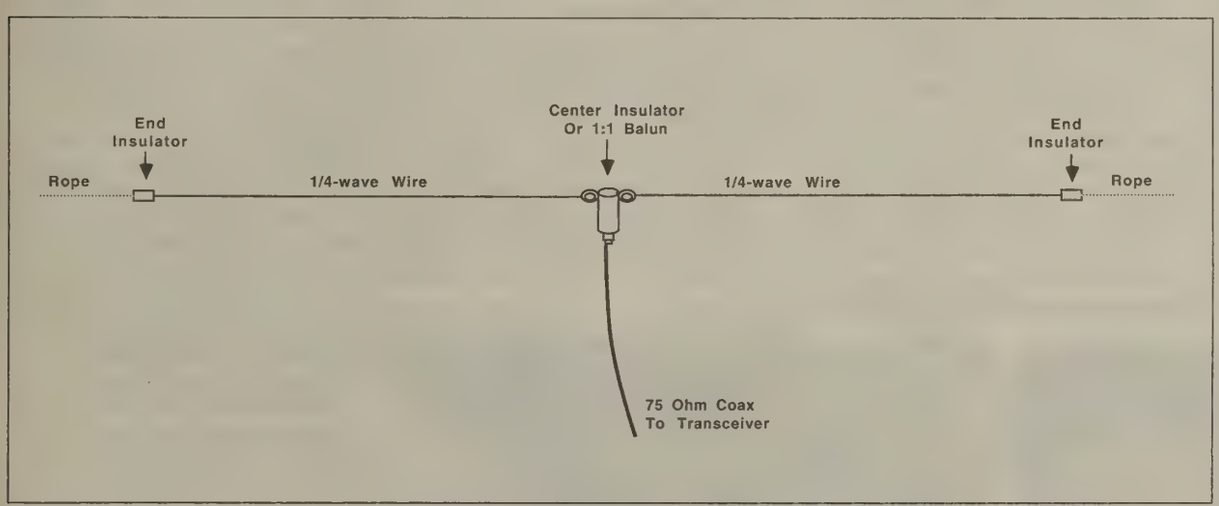
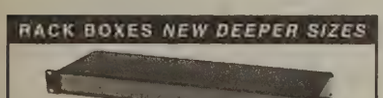


Figure 1. Half-wavelength dipole antenna.

Antlers for Windows

Calculating the lengths of antennas is usually a simple matter of remembering a constant based on the speed of light, and then dividing it by the frequency, usually expressed in megahertz (MHz). The rub comes when trying to remember the right constant for a particular style of antenna. The Antlers for Windows software will give you the lengths, and spacings where appropriate, for a large number of different wire and pipe antennas. It will also calculate the inductance and resonating capacitance for small loop antennas, the values for antenna tuning unit networks, high-pass filters, low-pass filters, resonant circuits, and the number of turns required to achieve a specified inductance in popular toroid cores. For each antenna, an on-screen graphic shows a schematic of the antenna. If you're interested in Antlers for Windows, contact me at POB 1099, Falls Church VA 22041. The introductory price is $30 postpaid. RF

RACK BOXES NEW DEEPER SIZES



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1RU12	19 x 12 x 1.75	42.75	3RU5	19 x 5 x 5.25	46.00
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1RU17	19 x 17 x 1.75	48.75	3RU10	19 x 10 x 5.25	51.00
2RU5	19 x 5 x 3.5	36.50	3RU12	19 x 12 x 5.25	54.00
2RU7	19 x 7 x 3.5	38.75	3RU15	19 x 15 x 5.25	57.00
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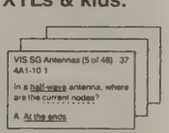

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by Gordon West WB6NOA

The Top Band: 10,000 MHz

Looking for some excitement on the amateur radio bands using voice with a no-code Technician class license? Or are you already a General, Advanced, or Extra Class license holder, and find that working worldwide is now "no big deal"? Whether a newcomer or an old-timer, if you are into exploring the new frontiers of amateur radio's microwave bands, 10 GHz may be for you! Ready-made transverter equipment is available, and the operating range at 10,000 MHz is often a lot greater than at 2 meters or 440 MHz.

It takes a Technician no-code license or higher for privileges up on 10,000 to 10,500 MHz. This is the very highest amateur radio band where you can buy transceiver equipment right off the shelf and get on the air immediately.

The 10 GHz band (properly pronounced 10 jig-a-hertz) is a popular one for the following modes:

FM control links
CW propagation beacons
Amateur television repeaters
Weak signal SSB communications

Power levels at these frequencies are a fraction of a watt. The over-the-counter transverter equipment you can buy normally runs no more than one-tenth of a watt output. But that's plenty to cover 300 miles from a hilltop on a hot, windless day using single sideband. And if you really get bitten by the 10 GHz bug, you can add a powerful traveling wave tube amplifier system to your setup and achieve power levels of up to 5 watts.

Tropospheric Ducting

But power output is not the big 10 GHz microwave range determining factor. What gives you good range at 10 GHz is the common VHF/UHF/microwave phenomena called tropospheric ducting. During periods of static high-pressure weather systems, the high-pressure cell sits over a large area of the country and coastline, and begins to descend. This is because a high-pressure cell has heavier air than what's below it, so the air begins to drop.

Dropping air begins to heat up. Just like compressing air in a tire pump, things get warm inside. Same thing with a tropospheric duct. As this heated air begins to interact with the cool air below it resting on the surface of the earth or over a large body of water, it flattens out into a well-defined "cap" that sits about 1,000 feet above the earth or ocean. You can many times see this "cap" of squished high-pressure air as an inversion layer that hangs over the water or land. Many times it mixes with smoke, and the smoke is seen as a horizontal band that extends for as long as the eye can see.

Inside this horizontal band of warm air is a radical temperature difference from the cool air below it. If the temperature is 10 degrees warmer inside the warm air duct it will dramatically refract VHF, UHF, and microwave frequencies along its path. Besides the 10 degree temperature difference there is also a sharp increase in air pressure (makes sense—it's getting squeezed), as well as a sharp increase in humidity because the pressure literally wrings out the moisture that is associated with this inversion layer.

June, July, and August are the most common months of tropospheric ducting, which causes microwave refraction. The largest tropospheric ducts occur between California and Hawaii, Chicago to Texas, and the Northeast to Florida. It's always associated with a stable high-pressure system, and you can literally "see" the tropospheric duct. This is the same condition that triggers long-range transmission and reception to distant 2 meter and 440 MHz repeaters that are separated by as much as 600 miles. This condition will last for hours, days and, in some cases, even up to a week.

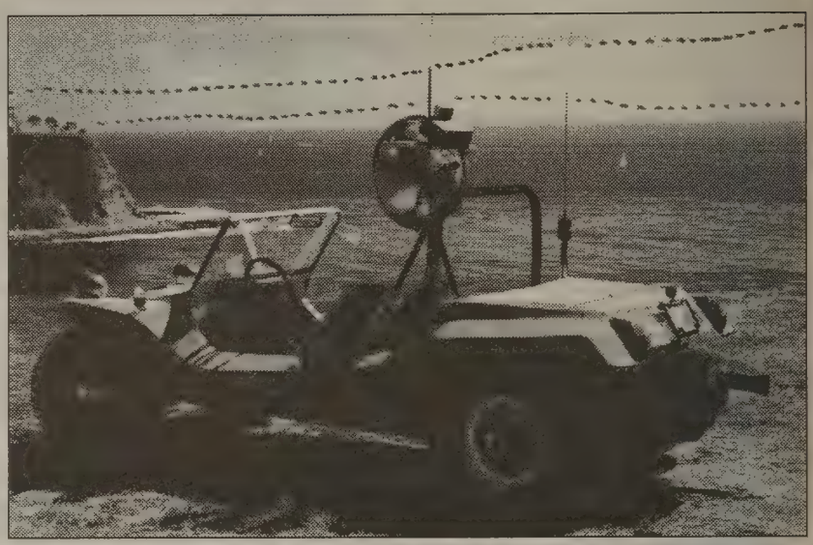

Photo A. The tropo duct can be seen on the horizon. It has been outlined in this photo for clarity.

Equipment Required

To take advantage of tropospheric ducting on 10 GHz, you first need to own a 2 meter single-sideband receiver. Operating on 2 meter SSB down around 144.200 will give you a good taste of what trop DX is all about. You need the capabilities of single sideband on 2 meters to really enjoy the advantage of weak signal transmission and reception. While you indeed can get some long-haul tropo contacts on 2 meters using FM, single sideband might go out 1,000 miles where FM might only reach out 400 miles.

To get up to the 10 GHz band from 2 meters SSB, you will need to employ a device called a "transverter." The transverter will take your incoming 144 MHz transmitted energy and convert it up via microwave multipliers for an output at 10,000 MHz. On receive, the transverter pulls in the signal and brings it down to the 144 MHz frequency for your 2 meter multimode rig to tune in.

A new transverter is now available from SSB Electronic USA (124 Cherrywood Drive, Mountaintop, Pennsylvania 18707; 717/868-5643). It will work up to one watt of drive, and automatically detects transmit and cycles on the multiplier stages and power amplifier to deliver a signal at 10 GHz. When you release the push-to-talk microphone on your 2 meter SSB rig, the set cycles back to receive, and the transverter cycles into receive and takes the 10 GHz reception down to 144 MHz output. Single sideband using upper sideband is the weak-signal voice mode.

Inside the transverter are modules that are pre-tested and pre-assembled for an easy assembly of getting on the air. The attachment to your 2 meter SSB transceiver will be antenna out to transverter antenna input, 12 volts for the transverter to operate on, and a hard-key line which is the preferred way of cycling from transmit to receive and back again when you key your set's microphone.

Until recently, it took some major modification of your existing 2 meter SSB transceiver to cut the power output to a safe level that wouldn't blow up the transverter. Jerry at SSB Electronics has now modified the circuit to take up to the common 1 watt output. But you may wish to go into your 2 meter SSB transceiver and disable the high-power output switch so you don't accidentally over-power your new $1,000 transverter box! 144 MHz input will normally lead to 10,368 MHz output.

Most of the CW and SSB activity will be found on the microwave bands where you dial in 144.1 MHz to 144.2 MHz using CW or upper sideband on your local transceiver.

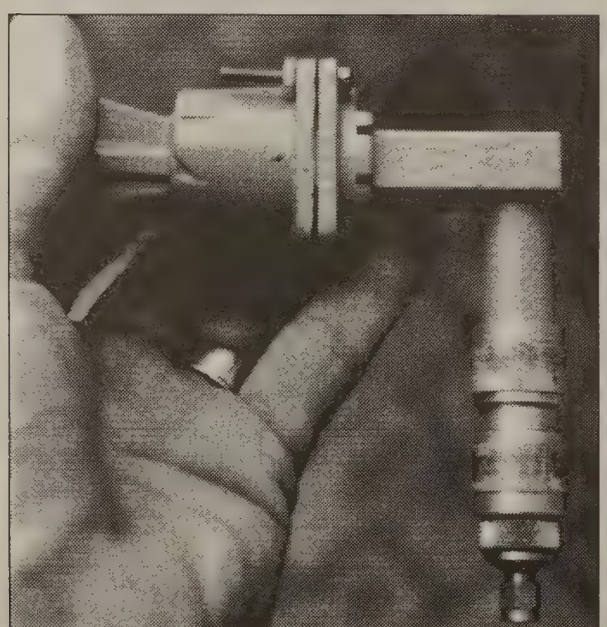

Photo B. The waveguide to N to SMA assembly necessary at 10 GHz.

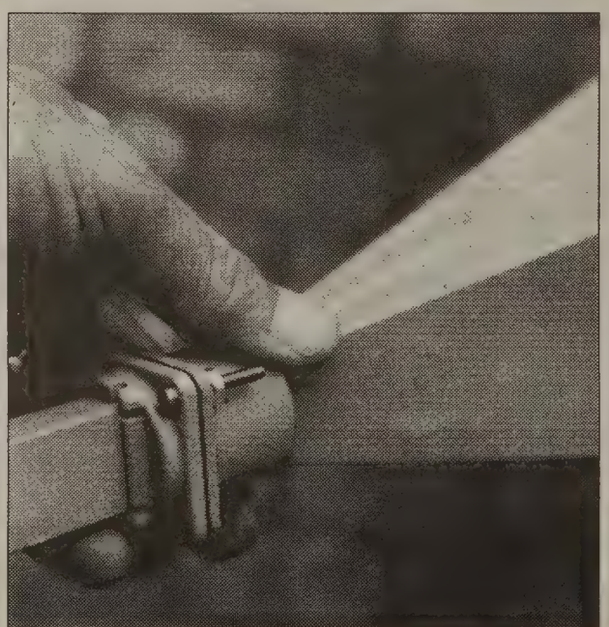

Photo C. At 10,000 MHz, perfect alignment of the waveguide joints is important!

Remember, no more than 1 watt output!

Your antenna system could be a simple horn antenna, or an elaborate dish. Up at 10,000 MHz, tremendous gain can be realized in relatively small dish antennas, which are far more practical than a conventional beam antenna. You may interconnect flexible waveguide to allow one person to operate the equipment and a second pal to aim the dish at the distant station. During August and September of this year, there will be plenty of microwave activity on the weekends, which also includes the two weekends for the ARRL 10 GHz contest.

Whenever you're working with microwave equipment, never stand in front of or look directly into an energized antenna system or waveguide. Microwaves could be dangerous to your eyes and health, so stay away from the business end of the microwave antenna system.

Hams are bouncing signals off of the moon using 10 GHz microwave equipment with TWT (traveling wave tube) amplifiers. Southern California hams have talked over 400 miles with 5 miliwatt, 10 GHz transverters. This summer we will participate in trying to establish a new record between California and Hawaii on the 10 GHz band.

So if you're looking for a new challenge, you want to build or buy a microwave station. There is plenty of room up on 10 GHz for both ham radio newcomers and oldtimers who want to say they made it to the very tip-top band. RF

Photo D. The small copper coax leads allow the "plumbing" of the TR switch at 10,000 MHz.

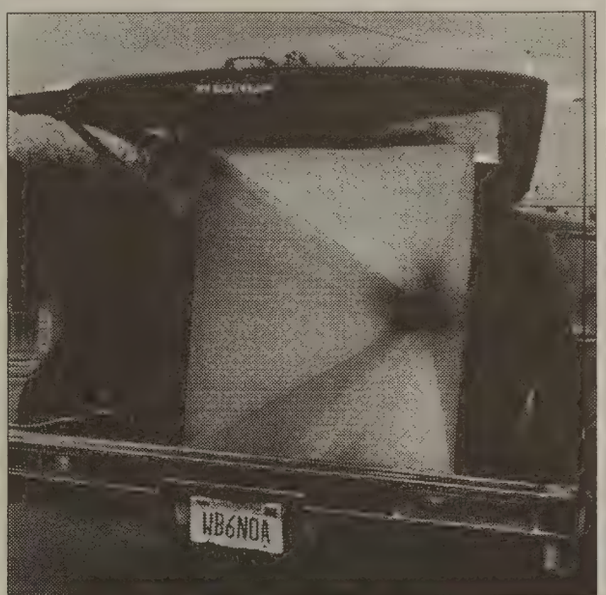

Photo E. 10 GHz California microwave mobile "rocket" station.

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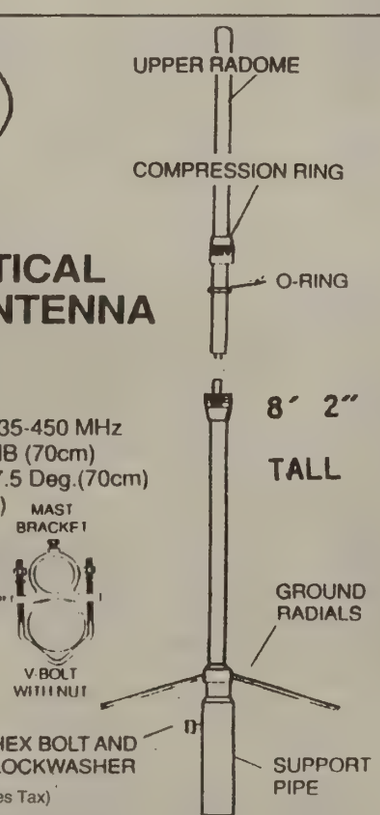

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what's next?

by Carole Perry WB2MGP

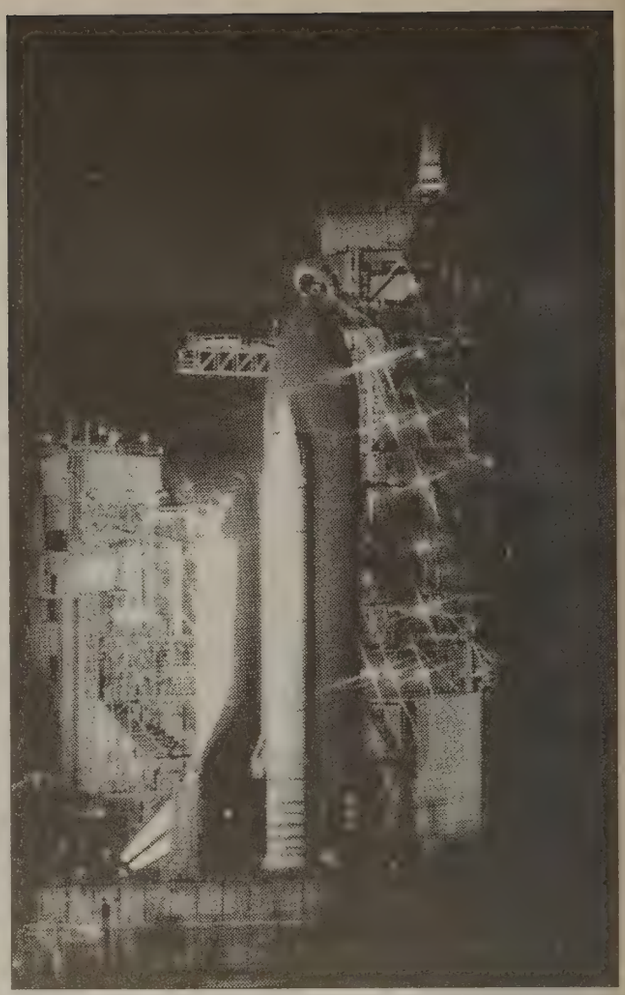

Photo A. Kennedy Space Center, Florida. Lights illuminate the space shuttle as it sits on the launch pad. (Photo by Ronald Palmisano, USSEA News Operations/Space Age Times.)

Spaceport USA

There are many great follow-up lessons and activities to do with ham radio classes after a unit on Space Travel and Communications. Every term the children come up with different approaches because of their various backgrounds and different interests. This term the kids were really "inspired" after eighth-grader Renée KB2QMR and I returned from viewing the launch of the *Endeavour* space shuttle on April 9th.

It was really going to be hard to top the "show and tell" that Renée and I came back with, but everyone rose to the challenge. Wonderful projects and reports about the shuttle, SAREX, and the history of the space program came pouring into my room. It's amazing to see what happens when you spark the imaginations and creativity of young people.

I had brought in a 6-foot-long close-up poster of a shuttle on the launch pad. A group of sixth-graders made a chart of interesting facts about the launch pad at the Kennedy Space Center. For example, the launch pad is constructed of 52,000 cubic meters (68,000 cubic yards) of reinforced concrete. On top of the pad are six steel pedestals used to support the launch platform and the shuttle package. Nearby are two service towers. The taller one is in a fixed position, and the shorter one is mounted on wheels so that it can swing away from the shuttle. These towers provide access to the rocket for astronaut boarding, payload installation, fueling and final checkout before launch.

During the actual launch, water spouts located in the flame trench and on the mobile launch platform will dump over 1.1 million liters (300,000 gallons) of water onto the pad area during a 20-second period to provide noise suppression and cooling.

Within the past year, Renée and several other ham radio students were fortunate enough to have spoken with several astronauts at the Johnson Space Center via our school radio. The youngsters enjoyed thinking of questions to ask the astronauts about space travel, life on board the shuttle, the role of amateur radio, etc., but upon our return from viewing the launch, Renée had even more questions and things that she was amazed about.

I made sure that we left time to visit and tour Spaceport USA. Guided bus tours of the Kennedy Space Center are offered every day of the year except Christmas. I strongly recommend that this tour be included in your plans when you visit the Spaceport. Our visit to the new Astronauts' Memorial was an emotional experience. The Space Mirror, which is part of the Memorial, rotates and tilts to maintain a constant position with respect to the sun. The fixed mirror assemblies in the back of the structure collect and focus the sun's rays through the clear letter inserts of the astronauts' names. These letter inserts are specially designed to redirect the light towards the viewers. The highly polished surface of the black granite reflects the sky, thereby suspending the brightly-lit astronauts' names among the clouds. It's awe-inspiring.

The students in my classes seemed to be spellbound as Renée and I shared our experiences about all the wonderful exhibits we saw at the Spaceport. My description of the Crawler Transporter had the children's mouths agape. I displayed a picture of me standing beside the giant treads of the crawler. The children stared with incredulous eyes because there really is no point of reference for the sizes of some of the things that relate to the shuttle transport.

The two Crawler Transporters are designed to move space vehicles to the launch pad. A transporter can lift and carry 6,577,200 kg (14,500,000 pounds). Each transporter is about half the size of a soccer field and weighs over 2,722 metric tons (6 million pounds). Propulsion is provided by two powerful diesel electric generators. The generators, in turn, power electric motors which turn the treads.

A hydraulic system can vary the transporter's height at either or both ends by as much as 7 meters (6 feet), thus keeping the cargo level at all times. The transporter requires a crew of 26.

Our visit to the launch and to the Spaceport stimulated great ideas for projects amongst the students. I think we'll have a whole new depth to the questions that the children will have the next time they get to speak to an astronaut on the radio. RF

Photo B. Sixth-grader Peter Kim.

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activities calendar

Send your announcements to: Radio Fun Activities Calendar, 70 Route 202-N, Peterborough NH 03458. We'll print as many as space allows, on a "first come-first listed" basis.

AUG 1

DOYLESTOWN, PA The Wyndmoor AR Rptr. Club of Doylestown will meet at the Doylestown Township Bldg. Community Room on Wells Rd., at 7:30 PM. Interested persons may call *Bob Agans, (215) 348-7966.* The Club features speakers and videotapes on topics concerning amateur radio. They get together to study for license tests, etc., and often schedule weekend excursions to ham radio events.

AUG 1-30

PITTSBURGH, PA For details regarding a Hamfest/Computer Show/Flea Market, contact *Catherine Crnhovich, Queen Roberta College, 3343 Webster Ave., Pittsburgh PA 15219.*

AUG 5-7

VERNON, BC, CANADA The 3rd annual Sky High Hamfest will be held by the North Okanagan RAC, at Silver Star Mt. Resort. Flea Market. Dinner & Dance. HF Station. More. Contact *North Okanagan ARC, P.O. Box 1706, Vernon BC V1T 8C3, Canada.* For hotel reservations, call *1-800-663-4431.*

AUG 6

CARLINVILLE, IL The Macoupin County ARC, Inc., will hold "Hamfest '94" at the Macoupin County Fairgrounds. 1/2 mile north of Carlinville, on Route 4. Doors open at 8 AM. VE Exams, all classes, pre-registration required. Talk-in on 146.82 and 443.400 (103.5 PL). For registration and info, call *(217) 854-8261.*

INDIANAPOLIS, IN The annual WA9SNT Hamfest will be held at ITT Tech. Inst., 9511 Angola Ct., from 8 AM-3 PM. Set-up at 6 AM. This event is sponsored by the ITT Radio Club. Talk-in on 145.25(-). Contact *Dave Johnston K9HDQ, (317) 875-8640.*

VALPARAISO, IN The Porter County Hamfest/Computer Show, sponsored by the Porter County ARC in co-operation with The Porter County Tourism Bureau, will be held at Porter County Expo Center. Doors open at 8 AM (set-up at 6 AM). VE Exams 9 AM-12 Noon. Talk-in on 146.775/-6kc 131.8 PL and 146.520 simplex. Contact *Rich N9QLQ, (219) 762-8701;* or send SASE to *PCARC HamFest, P.O. Box 1782, Valparaiso IN 46384-1782.*

AUG 7

CROOKED LAKE, ANGOLA, IN The Annual Land of Lakes Angola Hamfest, sponsored by the Land of Lakes ARC, will be held 6 AM-2 PM at Steuben County 4-H Fairgrounds, corner of 200W & 200 N. VE Exams for all classes. Talk-in on 147.180. 145.090 packet. 444.350 131.8 tone. 444.900/.100, 224.94, 53.050. Contact *Sharon Brown WD9DSP, 905 W Pkwy. Dr., Pleasant Lake IN 46779, Tel. (219) 475-5897.*

MARSHFIELD, WI The Marshfield Area ARS will hold their 3rd annual Picnic, in Wildwood Park, beginning around 11 AM. This is a Potluck/Swapfest. Talk-in on 147.180. Contact *Guy A. Boucher KB9GPJ, 107 West Third St., Marshfield WI 54449, Tel. (715) 384-4323. PACKETT:KB9GPJ @ W9IHW.WI.USA.NA.*

PEOTONE, IL The 60th annual Hamfest/Computer Festival, sponsored by Hamfesters Radio Club, Inc., will be held at Will County Fairgrounds 6 AM-3 PM. Flea Market. Set-up Sat. Aug. 6th at 6 PM-12 midnight. Talk-in on 146.52 simplex, 146.64(-) (courtesy of STARS); 146.94(-) (courtesy of KARS). For info, call *(708) 535-AHAM.* For advance tickets, send SASE and check by July 20th to *David F. Brasel NF9N, 6933 W. 110 St., Worth IL 60482, Tel. (708) 448-0580.*

WELLESLEY, MA The Wellesley ARS and the Babson Wireless Club will co-sponsor a Ham Flea Market from 9 AM-2 PM at Trim Hall, Babson College. VE Exams at 11:30 AM (register by 11 AM). Bring exam fee of $5.75 (checks made out to ARRL/VEC), an original and a copy of your license, an original and a copy of any CSCEs held, a calculator and a pen. To reserve tables, contact *Barbara Holdridge N1ICQ, 107 Church St., Westwood MA 02090, Tel. (617) 329-2628.* VE Exams Contact: *Gerry Driscoll NV1T, 107 Church St., Westwood MA 02090, Tel. (617) 444-2686.*

AUG 13

TACOMA, WA The Radio Club of Tacoma will have its annual Flea Market at Charles Wright Academy, 7723 Chambers Creek Rd. W., from 9 AM-3 PM. VE Exams at 10 AM. Commercial and non-commercial venders MUST pre-register for tables. Talk-in on 148.28. Contact *Alan Allen N7EAY, P.O. Box 11188, Tacoma, WA 98411, Tel. (206) 475-7413.*

AUG 13-14

SHREVEPORT, LA The Shreveport ARA "ARK-LA-TEX" Hamfest will be held at Bossier City Civic Center, Benton Rd., Bossier City LA. Time: Sat. 8:30 AM-4:30 PM: Sun. 8:30 AM-1 PM. VE Exams, Forums, Banquet. Talk-in on 147.03. Contact *Alice B. Prudhomme KG5ZZ, Rt. 1 Box 410, Mansfield LA 71052, Tel. (318) 872-5988 after 6 PM.*

AUG 14

CHARLOTTE, NC Roll-A-Round Skate Center, 8830 East Harris Blvd., will be the location for the Charlotte ARC Hamfest/Computer Fair. Time: 8 AM-4 PM. Flea Market spaces are limited and must be pre-registered. Talk-in on 147.06(-), 444.85(+).For more info, call *(704) 522-4971, Ext. 3330.* Make checks payable to *Charlotte ARC,* and send with SASE (before Aug. 1st) to *Charlotte ARC, P.O. Box 33582, Charlotte NC 28233-3582.*

NAZARETH, PA A Hamfest/Computer Show will be held by the Delaware-Lehigh ARC, Inc. at the Career Institute of Tech., Easton PA, starting at 8 AM. Set-up at 6 AM. VE Exams. Demo Ham Station. Electronics Test Bench, and more. Talk-in on 146.10/.70 W3OK Rptr. Contact *Bill Goodman K3ANS, (610) 253-2745 or (610) 258-5060.* Also call *DLARC Answering Service at (610) 820-9110.* Make checks payable to *Delaware-Lehigh ARC, Inc.,* and mail to *The Delaware-Lehigh ARC, Inc., RR 4 Greystone Bldg., Nazareth PA 18064-9211.*

AUG 20

ALBUQUERQUE, NM The Duke City Hamfest is scheduled to be held at the New Mexico Army Nat'l. Guard Armory, 600 Wyoming Blvd., N.E. Hours: 7 AM MDT-5 PM MDT. Set-up Aug. 19th after 6 PM. For details about VE Exams, please call *Bob Witter at (505) 292-3218.* Flea Market spaces by pre-registration only. For info call *KC5FT or KB5SF at (505) 821-2771.* Make checks payable to *The Duke City Hamfest,* and mail with SASE prior to Aug. 11th to *Duke City Hamfest, P.O. Box 6552, Albuquerque NM 87197-6552.* Talk-in on 147.10 (+600 kHz) with back up on 147.15 MHz (+600 kHz). No one under the age of 15 admitted without parent or guardian.

LONGVIEW, WA The Lower Columbia ARA will host their 3rd annual Ham Radio/Computer/Electronic Equip. Swap Meet from 9 AM-3 PM at Cowlitz County Fairgrounds. Set-up Aug. 19th 5 PM-9PM; Aug. 20th, 6 AM-8:45 AM. Talk-in on 147.26(+) K7ZVV Rptr. For info, call *(206) 425-6076, (206) 425-9184, or (206) 425-1866.* Make checks payable to *LCARA,* and mail to *LCARA Swap Tables, P.O. Box 906, Longview WA 98632.*

AUG 20-21

HUNTSVILLE, AL The 1994 Huntsville Hamfest will be held at the Von Braun Civic Center. Doors open to the public at 9 AM on both days. Dealer Show/Flea Market. Tech. Forums. Banquets, and more. The nearby Huntsville Hilton hotel is participating by offering special Hamfest rates. Talk-in by K4BFT on 146.34/.94 MHz. For info, call *(205) 534-7175,* or write to *Huntsville Hamfest, P.O. Box 12534, Huntsville AL 35815.*

AUG 21

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club will hold a Flea Market from 9 AM-2 PM at Albany and Main St. For details call *(617) 253-3776.* Mail advance reservations before Aug. 5th to *W1GSL, P.O. Box 82 MIT BR., Cambridge MA 02139.* Talk-in on 146.52 and 449.725/ 444.725 PL 2A W1XM Rptr.

MARYSVILLE, OH The 18th Annual HamFest of the Union County ARC will be held at the Union County Fairgrounds near Columbus OH. Radio equip./Computer products. Flea Market. Contact *Gene Moore N8YRF, 24461 Claibourne Rd., Marysville OH 43040, Tel. (513) 246-5943.*

AUG 26-28

SAN DIEGO, CA The 1994 ARRL Southwestern Div. Convention will be hosted by the San Diego AR Council, Inc. at the Town and Country Convention Center off of I-8 in San Diego. Times: Fri. 3 PM; Sat. 9 AM-4 PM; Sun. 9 AM-Noon. Harbor Dinner Cruise Fri. night. Banquet Sat. eve. featuring Steve Roberts N4VRE and Behemoth. VE Exams. There will also be an ARRL ceremony for Wouff Hong. Talk-in on 145.320 - 107.2 PL. For info call *(619) 278-4284.* To pre-register, contact *Bob Boehme, 10340 Evereli Place, Santee CA 92071.*

AUG 27

BRIDGEWATER, NJ The Somerset County ARS Inc. will hold their annual Hamfest at the Somerset County 4H Center on Milltown Rd., just off of Route 202. Time: 8 AM-1 PM. Set-up at 6 AM. Talk-in on 448.175(-). Contact *Donna, or George N2RQH, (908) 369-4533.* Or write to *SCARS, P.O. Box 742, Manville NJ 08835.*

CHAFFEE, NY The Arcade Kiwanis will sponsor the Pioneer Radio Operators' Soc. 3rd annual Chaffee Hamfest/Computer Show from 7 AM-3 PM at Manion Pk. Talk-in on 145.390 and 444.175. Advance registration tickets $3 each (Flea Market set-up included). Make checks payable to *Mike Wrona, 139 Greenmeadow Dr., West Seneca NY 14224.* Please include an SASE.

RHINELANDER, WI The Northwoods ARC, ARES, Rhinelander and Tomahawk Rptr. Assns. will co-sponsor the Northwoods Swapfest. Doors open 8 AM-2 PM at Sugar Camp Town Hall, 13 miles north of Rhinelander, on Hwy. 17. VE Exams: Registration 10:30 AM, testing at 11 AM. Contact *Mary Berger NS9Q, 367 Lois St., Rhinelander WI 54501, Tel. (715) 362-9296.*

AUG 28

LEBANON, TN A Hamfest will be held at Cedars of Lebanon State Pk., U.S. Hwy. 231, 7 mi. south of I-40. The Short Mountain Rptr. Club will host this event 7 AM-3 PM. Talk-in on 146.91. Contact *Mary Alice Fanning KA4GSB, 4936 Danby Dr., Nashville TN 37211, Tel. (615) 832-3215.*

WOODSTOCK, IL The Tri-County Radio Group, Inc. will hold its Hamfest/Computer Show at the McHenry County Fairgrounds located just of Route 14 on Route 47, beginning at 6:30 AM for Fleamarket, and 8 AM for exhibitors. (Set-up Sat. by appointment, or 6:30 AM on Sun.) Talk-in on 146.52 simplex. Reservation deadline is Aug. 10th. Write to *T.C.R.G., P.O. Box 3107, Skokie IL 60076-6107;* or call *Robert N9KXG, (708) 658-1678.*

YONKERS, NY A Hamfest/Computerfest, sponsored by the Yonkers ARC, will be held 9 AM-3 PM at the Yonkers Municipal Parking Garage on Main St. Talk-in on 146.865, 440.150 MHz. Pre-registration is $10 per space. Make checks payable to the *Yonkers ARC* and send your order with an SASE to *Y.A.R.C., P.O. Box 378, Centuck Sta., Yonkers NY 10710-0378.*

SEPT 17

SCOTTSDALE, AZ The Family AR Event will hold its 2nd annual event at Rawhide Western Town, 23023 N. Scottsdale Rd. RC airplane demo. Weather sat. forums. Emergency Ham Radio. Activities for children. Swap meet area opens at 6 AM. Exhibit hall opens at 9 AM. Contact *Len Winkler KB7LPW, P.O. Box 9219, Phoenix AZ 85068, Tel. (602) 861-0303.*

SPECIAL EVENT STATIONS

AUG 5-7

MACUNGIE, PA Local hams will operate W3TEB on the General 80, 40 and 20 meter phone subbands and 146.55, in conjunction with the 31st annual Das Awksch Fescht (PA Dutch for "August Festival" - A Festival and Antique Car Show). For a certificate, send QSL and SASE to *Henry Buchin W3TEB, 21 East Main St., Macungie PA 18062-1308.*

AUG 6-7

BARNEGAT LIGHT, NJ The Old Barney ARC will operate W2OB from "OLD BARNEY," the Barnegat Lighthouse (Long Beach Island IOTA NA-111), to commemorate Nat'l Lighthouse Day. Time: 3000 UTC-0000 UTC each day. Frequencies: Look in the lower 25 kHz of the General phone bands: 40, 20, 15, and 10 meters, plus 146.52 simplex. 146.835 Rptr., and other local Rptrs. For a special QSL, send a 9" x 12" SASE with 2 units of postage, via NU2F. For more info, contact *QSL W2OB via NU2F, Joe Fleishinger Sr., 75 Joshua Dr., Manahawkin NJ 08050 USA.*

AUG 7-13

POTTSVILLE, PA The Schuylkill ARA will operate N3ILC Aug 7th-Aug 13th, to celebrate the Schuylkill County Fair. Operation will be both CW and phone on the General and Novice subbands. For a certificate, send QSL and SASE to *Ed Brennan N3ILC, 520 Spring Garden St., Pottsville PA 17901-1651.*

AUG 12-16

WEST ISLAND, MONTREAL, CANADA Members of the West Island ARC are planning the club's 3rd expedition to St. Paul Island (off the northern tip of Nova Scotia). IOTA NA-94. The group plans to operate CW, SSB, and RTTY from this DXCC country, using the call CY9CWI. Operation will be on 40, 80, and 160 meters. Operations will start at 0000Z on Aug. 12th and continue through Aug. 16th. Frequencies: (MHz) 1.830-50, 3.505-15, 3.780-3.800, 7.040-7.060, 7.250, 10.110, 14.040, 14.195, 18.080, 18.120, 21.040, 21.320, 24.940, 28.120, 28.495. RS-12: Tx 21.220, Rx 29.420, RTTY 7.090, 14.090. Listen for operators Reg. VE2AYU, Coos. VE2GTI, Jean VE2JCX, Jean VE2TBH, Lowell VY2OX, Fred VE2SEI, Andrew VE2WHO, Helen VE2YAK, and Margaret VE2ZOO. VE2YAK and VE2ZOO will be especially looking for ops trying for YL DXCC. Address QSLs to *West Island ARC Inc., P.O. Box 884, Pointe-Claire/Dorval QC, Canada H9R 4Z6.* For more info, contact *Fred Archibald VE2SEI, 130 Embleton Cres., Pointe Claire QC, Canada H9R 3N2.*

AUG 13

CENTERVILLE, GA The employees of Georgia Power Co. (Plant Scherer) and friends will operate Station AD4FC to commemorate the company's dedication to the environment and the community. The event will begin at 1200 UTC and end at 2400 UTC. Operation will be in the lower 25 kHz of 80, 40, 20, and 15 meter General class phone subbands, and in the 10 meter Novice class phone subband. For a certificate, send a 9" x 12" SASE to *Don Hall AD4FC, 262 Valencia Cir., Centerville GA 31028.* There will also be VE Exams and a Tailgate Swapfest.

AUG 13-14

FALL RIVER, MA Station W1ACT will operate from aboard the tall ship "H.M.S. Bounty" as part of the annual "Fall River Celebrates America" Festival. Operations will be on 2, 6 and 10 through 160 meters, using CW, SSB, and FM. The Station will operate 1400Z Aug. 13th-1400Z Aug. 14th. To get a QSL card, please QSL via *Ed Walsh WV1L, 798 Second St., Fall River MA 02721.*

AUG 14

FULTON, NY The Oswego County AR Emergency Service will operate Station KC2QV 1200Z-2100Z from Fulton's annual Riverfest. Operation will be in the middle of the General 80, 40, 20, 15, and 10 meter phone bands, the Novice portion of 10 meters, and 147.75/.15 MHz. For a certificate, send your QSL card and a large SASE to *KC2QV, 366 South Fifth St., Fulton NY 13069.*

AUG 19-SEP 5

ISLINGTON, ONT., CANADA Amateur Radio clubs around Toronto Canada will operate Station VE3CNE 1400Z-0200Z each day as part of the Canadian Nat'l Exhibition in Toronto. Frequencies: CW—80 meters: 3.645/.700 MHz; 40 meters: 7.045/.145 MHz; 20 meters: 14.045; 15 meters: 21.045/.145 MHz. SSB—80 meters: 3.745/.865 MHz; 40 meters: 7.065/.235 MHz.; 20 meters: 14.145/.245 MHz; and 21.345 on 15 meters. Talk-in on 145.410 MHz. Contact *(416) 393-6000* for more details.

AUG 20-21

ENGLEWOOD, NJ The Englewood ARA will host the 35th annual New Jersey QSO Party 2000 UTC Aug. 20th-0700 UTC Aug. 21st, and 1300 UTC Aug. 21st-0200 UTC Aug. 22nd. Frequencies: 3535, 3950, 7035, 7235, 14035 and 14285. For rules and info, send SASE to *EARA, P.O. Box 528, Englewood NJ 07631.*

MALACCA, Malaysia The Malaysian AR Transmitter Soc. is inviting all Hams to attend the 22nd annual Seanet Convention in Malacca on the 11th, 12th and 13th of November 1994. To aid in this endeavor, they are hosting the "Seanet World Wide DX Contest 1994." Their SSB contest is 0001Z Aug 20th-2359Z Aug 21st. Operation will be on 160, 80, 40, 20, and 10 meters (no WARC bands). For more info, please write to *Seanet Contest Manager 1994, Eshee Razak 9M2FK, P.O. Box 13, 10700 Penang, Malaysia.* Please enclose your self-addressed envelope and adequate IRCs for a reply.

VANCOUVER, WA The Northwest Antique Aircraft Club will sponsor the annual Fly-in at Evergreen Flying Field, just east of Vancouver. The Clark County ARC will operate Station W7AIA at the field. Operation will be in the lower portion of the General phone bands on 75, 40, 20, and 15 meters, and possibly in the Novice portion of the 10 meter band. Local Hams, tune in on 2 meters, 146.52 MHz. To get a certificate, send your QSL and SASE to *CCARC, P.O. Box 1424, Vancouver WA 98668.*

AUG 27

LUKE, MD The Appalachian Radio Amateur Assn. will sponsor Family Day at Westvaco Fine Paper Div., and will operate N0BSD from 1200Z-2000Z, to commemorate the annual Family Day event. Operation will be in the General bands: Phone—7.265, 21.365, 14.265, 3.925 (on the hour), and CW—7.040, 21.040, 14.040, 3.540 (on the half hour). Also, 2 meter packet on 145.070. For a certificate, send QSL and a 9" x 12" SASE to *Kenneth D. Currence, 18614 Woodlawn Dr., Rawlings MD 21557.*

SEP 2-4

HAGERSTOWN, MD The Antietam Radio Assn. will operate Club Station W3CWC to commemorate the 125th Anniversary of the birth of Hiram P. Maxim W1AW, Founder of the A.R.R.L.. They will also celebrate the installation of a brass headmarker at his grave site in Rose Hill Cemetary. Operation will be from 1500Z Sep. 2nd-0400Z Sep. 3rd; also, 1200Z Sep. 3rd-2400Z Sep. 4th. Frequencies: CW—3.640, 7.045, 14.040, 21.040, 28.040. SSB—3.920, 7.240, 14.240, 21.295, 28.350 MHz. For a commemorative certificate, send your QSL and an SASE to *Antietam Radio Assn., Attn: Special Event Station W3CWC, P.O. Box 52, Hagerstown MD 21741-0052.*

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The Deadline for the September 1994 Flea Market is June 16, 1994.

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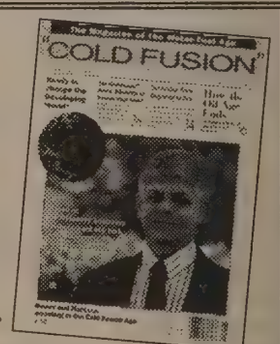

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What You Missed in 73 Amateur Radio Today

Missing Something?

If you're not yet reading *73 Amateur Radio Today* you are missing considerable. For instance, if you're interested in new ham products, *73* reviews 'em first and reviews the most. And they're reviews by our readers, not just the usual puff pieces by a staff member who knows where his paycheck is coming from.

If you're looking for small construction projects, *73* has more of 'em than any other ham rag, by a wide margin. How about antennas? You'll find a ton of antenna articles.

Then there are Wayne's controversial editorials. Well, he sure says what he thinks. In February Wayne reported briefly (for a change) on his recent Caribbean visit to amateurs and his scuba diving adventures. A 96-page detailed report on Frugal Wayne's Caribbean Adventures is available for a measly $7.50 postpaid from Uncle Wayne's Bookshelf. Then he discusses electromedicine, how our bodies work on analog microcurrents, and how this has led to a cure for AIDS and addictions . . . and even snakebites. He discusses the Albert Einstein College of Medicine's astounding breakthrough in AIDS and how amateurs might fit into an AIDS rescue effort.

In March Wayne tries to decide about going to Dayton. Is the lighting in your home helping to make you and your family sick? There's no doubt about it. Ditto lighting in schools and offices. You'd better not read this. Wayne explains why cold fusion has been such a sleeper and now looks like the most exciting discovery of the 20th century. He explains why democracy has failed so badly in America, and what went wrong with Perot's United We Stand America. He also proposes a great way to get involved in the music business.

In April Wayne discusses good vs. bad science, including ecoscams such as acid rain, the greenhouse effect, the ozone hole, and so on. He points out the importance of checking anomalies in science carefully and not just ignoring them. He cites a new approach to treating breast cancer. And for anyone entrepreneurially inclined he suggests more ways to get into the music business and have a ball while making money.

In May Wayne explained why he skipped Dayton this year. He also talked about America's most famous spy in history, Amelia Earhart, and recent exciting developments in cold fusion, together with the opportunity this offers for amateurs. He fulminates over the blindness of American media, the development of an AIDS cure kit, the remarkable resistance of science down through history to new ideas. You'll be reading Wayne's "I'm Proud to be an American" over the air to anyone who hasn't read it.

In the June issue he proposed reinventing hamfests as a way to invigorate the hobby. He took some ham manufacturers to task for lousy customer service. He explains a simple way you can make your contacts more interesting. Much more interesting. He then discusses the information superhighway and its probable impact on amateur radio, which could be disastrous. But he also proposes a way we can counter this trend.

Well, you get the idea. You're missing a lot of information and a lot of fun if you're not subscribing to *73*. No, there aren't a bunch of pages devoted to club news or contests like some other magazines we could mention. The May *QST* has 20 pages of real articles, plus the usual columns. Then comes club news and contest reports, plus a few ads for another 214 pages. That's great if you're that interested in club news and contests.

PUT SOME EXCITEMENT BACK INTO YOUR HOBBY!

73 Amateur Radio Today

No other magazine brings you the exciting world of amateur radio like *73 Amateur Radio Today.*

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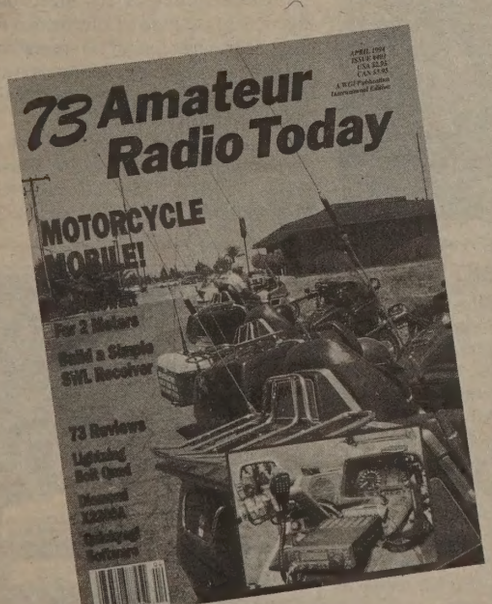
• "Never Say Die," Wayne Green's monthly view of the world of amateur radio.



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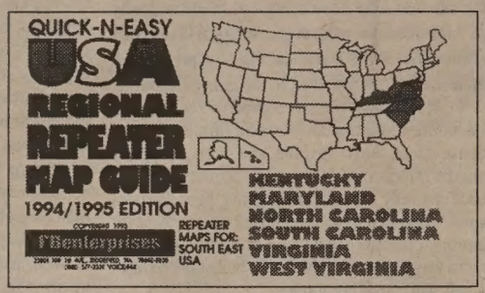
new products

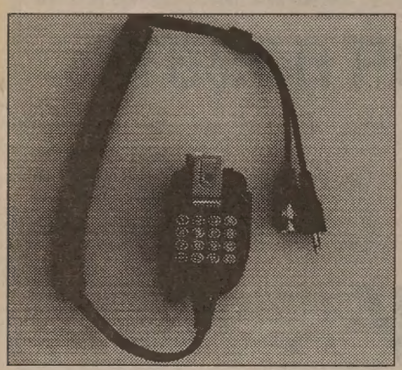
FB ENTERPRISES



FB Enterprises has introduced a new line of Quick-N-Easy Regional Repeater Map Guides. The map guides are available for 10 different regions, covering all 50 US states.

Each regional guide covers six different states, and they are spiral bound for easy use. The guides are laminated in clear plastic to protect them from spills or tears. They show 2 meter repeaters in full color on the front of each card and bands from 220 MHz to 1.2 GHz in black and white on the back.

The guides are priced at $9.95 plus $3 shipping for mail orders. They are also available at many dealers. Product catalogs are available for $2 (refundable with purchase). For more information please contact *FB Enterprises, 23801 NW 1st Ave., Ridgefield, WA 98642-8830; (800) 377-2339 (voice or FAX).* Or circle Reader Service No. 201.



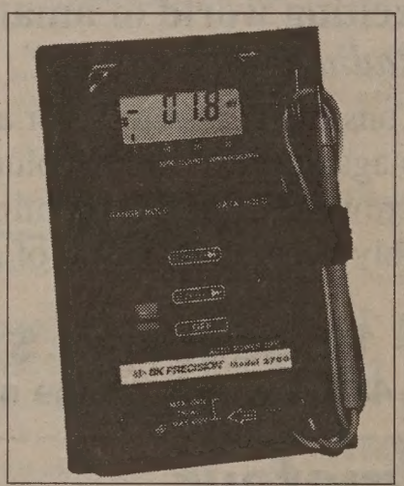
EUR-AM ELECTRONICS

EUR-Am Electronics has introduced a new speaker/microphone equipped with its own BNC connector. Now you can affix your HT's antenna to the speaker/mike like many law enforcement units do.

Other features on these speaker/mikes include a convenient earphone jack and DTMF (dual-tone multi-frequency) keypad. This item will fit most Yaesu and Icom HTs, along with many other brands.

For more information contact *EUR-AM, P.O. Box 990, Meridith, NH 03253-0990; (603) 279-1393; FAX (603) 279-1394.* Or circle Reader Service No. 203.

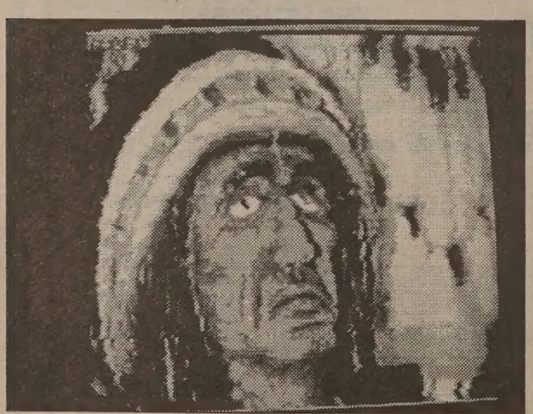
B+K PRECISION



B+K has introduced their first digital multimeter that is truly pocket-sized—the instrument is only 4.4" x 2.2" x 0.4" and weighs only 3.5 ounces with batteries. The Model 2700 DMM measures AC and DC volts and resistance with data hold, range hold, audible continuity test, diode test, bar graph, and 3200 count LCD display.

Data hold freezes the display to hold a reading. Range hold allows the user to defeat autoranging and select one specific voltage or resistance range for all measurements. This is the only pocket DMM to offer all these features.

For more information, visit your favorite dealer or contact *B+K Precision, 6470 W. Courtland St., Chicago, IL 60635; (312) 889-1448, FAX (312) 794-9740.* Or circle Reader Service No. 204.



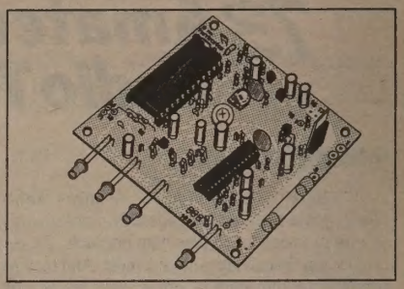
HARLAN TECHNOLOGIES

Harlan Technologies has announced Color Slow Scan TV for the Sound Blaster sound card. This new version is an upgrade from Slow Scan II, which would copy color modes but display them in black and white. Color Slow Scan will send and receive Robot 8, 12, 24, and 36 second black and white, but will also send and receive Robot 36 and 76 second color, Scotty 1, and Scotty 2 displaying in full color.

Hookup of the Sound Blaster compatible card to your radio equipment is very easy. The sound from the receiver is connected to the microphone input of the sound card, and for transmit, one channel of the stereo output from the card is connected to the microphone input of the transmitter.

Color Slow Scan is priced at $99.95 plus $5 shipping (overseas shipping $10; Illinois residents add $6.25 tax.) For more information or to order, contact *Harlan Technologies, 5931 Alma Drive, Rockford, IL 61108; (815) 398-2683.* Or circle Reader service No. 206.

HAMTRONICS



Hamtronics has announced the new COR-6 module—a voice ID repeater controller combining COR circuits and a real-voice ID on one board. It can be used with transmitter and receiver modules to make a simple, low-cost repeater.

A digital IC records up to 20 seconds of your voice, using audio from the repeater receiver. The unit includes tail and time-out timers, courtesy beep, and a solid-state relay to key the transmitter.

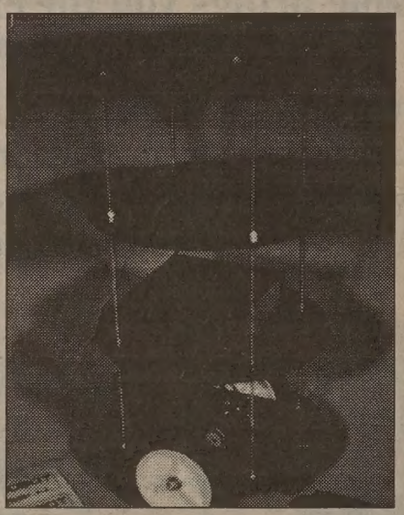
The kit price is $99, or the unit is available wired and tested for $149. A catalog is also available. For more information contact *Hamtronics, Inc., 65-F Moul Rd., Hilton, NY 14468-9535; (716) 392-9430, FAX (716) 392-9420.* Or circle Reader Service No. 202.

KANGAROO TABOR SOFTWARE

Kangaroo Tabor Software has announced the new CAPMAN 2.0 computer-assisted prediction manger. This is a professional-quality IONCAP package that allows anyone to use the most advanced propagation routine interfacing with the ELNEC and MININEC antenna analysis gain patterns.

CAPMAN is the versatile menu-driven skyway analysis package developed by Kangaroo Tabor Software and the prime author of IONCAP. CAPMAN delivers IONCAP input file construction and management, two integrated execute functions, the ability to view and manipulate huge output files, and graphical display of output parameters for multiple target locations and time periods.

This product contains a full-featured location database and can be easily customized. The CAPMAN package requires a 386 or better PC or compatible. The IONCAP program is included in the CAPMAN package, which is priced at $89 ppd. in the USA (elsewhere add $3.50 S & H). For more information contact *LUCAS Radio/Kangaroo Tabor Software, 2900 Valmont Rd., Suite H, Boulder, CO 80301; (303) 494-4647, FAX (303) 494-0937.* Or circle Reader service No. 205.



ACLYPSE CORPORATION

Aclypse Corporation has announced the ADR-1 Robot Kit, a little something different for the ham who has everything. The robot is 27" tall x 14" in diameter and weighs 16 pounds. The complete kit has an onboard computer system that features voice recognition capabilities, English speech output, power motor drive, and a battery with monitoring and recharge system.

No electronics or advanced computer experience is required. Construction takes two to six hours and requires no special tools. The robot has its own operating system and a BASIC programming language is built in. The complete kit is priced at $299.

For more information contact *Aclypse Corporation, Rt. 2, Box 213H, Worthington, IN 47471; (812) 875-2852, BBS (812) 875-2836.* Or circle Reader Service No. 207.

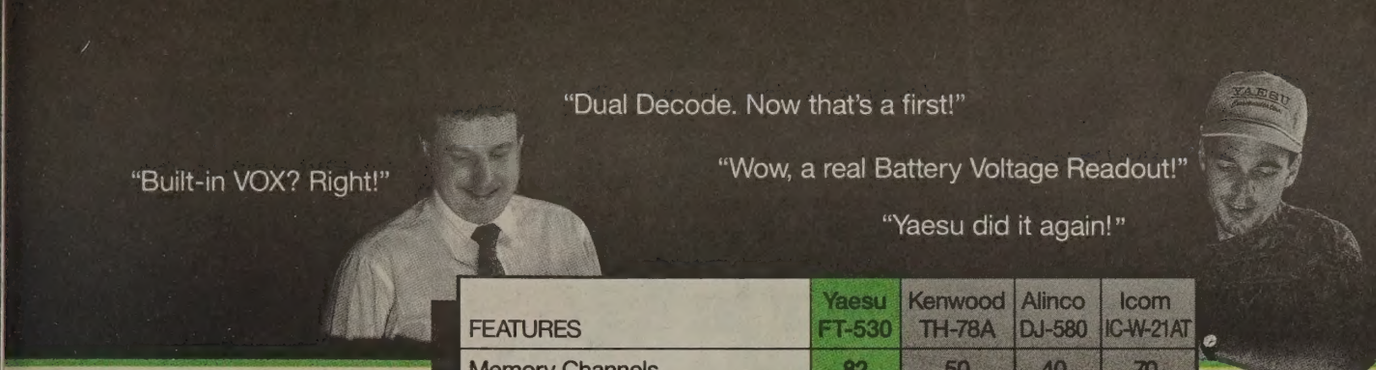
GORDON WEST RADIO SCHOOL

The amateur radio General Class Element 3B question pool has been revised as of July 1, 1994. The new question pool will be valid for four years, and reflect the exact 288 questions and answers now found on amateur radio General Class tests. All of the Gordon West Radio School books and cassettes have been updated to coincide with this change.

"Only the General Class Element 3B question pool was changed last July," says Gordon West WB6NOA. "All other amateur radio question pools remain exactly the same, and the Advanced Class pool is next for revision in about nine months," adds West.

The new General Class audio cassettes also cover all the new General Class questions. They have been completely updated in stereo to make learning convenient and fun, whether exercising at home or driving in the car.

The updated books and cassettes are available at your favorite dealer, or you can order the autographed set direct for $19.95 plus $3 S & H. For more information or to order contact *Gordon West Radio School Inc., 2414 College Drive, Costa Mesa, CA 92626; (714) 549-5000 (Hot Line 10-4 PM); (714) 434-0666 (Info Line 24 hrs).* Or circle Reader Service No. 208.



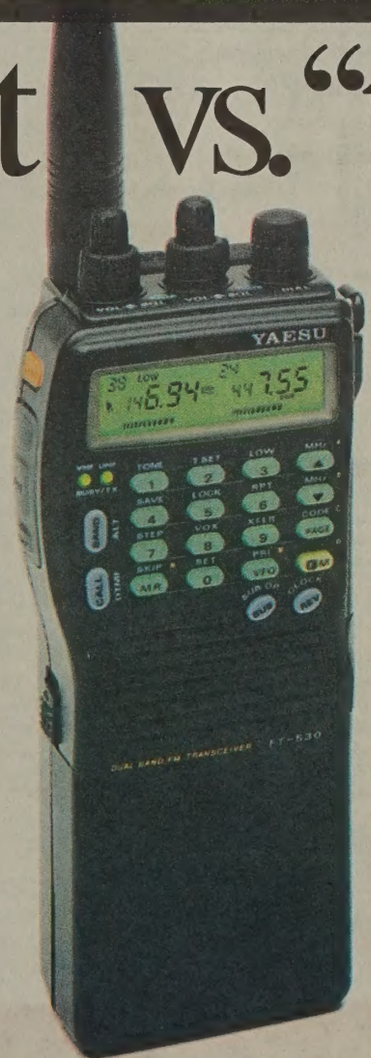
FEATURES	Yaesu FT-530	Kenwood TH-78A	Alinco DJ-580	Icom IC-W-21AT
Memory Channels	82	50	40	70
Slide-out Lithium Battery	YES	NO	NO	NO
Dual CTCSS Decoder	YES	NO	NO	NO
Battery Voltage Readout	YES	NO	NO	NO
Automatic CTCSS Tone Search	YES	NO	NO	NO
Transmit Battery Saver (Repeater & Simplex Operation)	YES	NO	NO	NO
Built-In Vox	YES	NO	NO	NO
One Touch Reverse Button	YES	NO	NO	NO
Dual In-Band Receive (V+V, U+U)	YES	YES	NO	YES
Programmable External Speaker Audio	YES	NO	NO	NO
Optional Digital Display Mic with "S" Meter	YES	NO	NO	NO
AM Aircraft Receive	YES	YES	YES	YES

The Best vs. "the rest".

FT-530
Dual Band Handheld

- **Frequency Coverage:**
  2-Meter 130-174 MHz RX
  144-148 MHz TX
  70 cm 430-450 MHz RX/TX
- 4 TX Power levels:
  w/FNB-25: 2.0, 1.5, 1.0, 0.5W
  w/FNB-27: 5.0, 3.0, 1.5, 0.5W
- DTMF Paging and Coded Squelch
- AOT – Auto On-Timer with built-in clock and alarm functions
- IBS – Intelligent Band Select (provides automatic TX band select on scan stop)
- Backlit keypad and display with time delay
- Built-in cross-band repeat function
- APO – Automatic Power Off
- 5 Watts output w/ FNB-27 battery or 12 VDC
- 2 VFO's for each band
- **Accessories:**

NC-42 1-Hour Desk Charger
FNB-25 600 mAh Battery (2 watt)
FNB-26 1000 mAh Battery (2 watt)
FNB-27 600 mAh Battery (5 watt)
FBA-12 6 AA Cell Holder
CSC-56 Vinyl Case w/ FNB-25
CSC-58 Vinyl Case w/ FNB-26/27
E-DC-5B 12 VDC Adaptor
YH-2 Headset for VOX
MH-12A2B Speaker Mic
MH-18A2B Lapel Speaker Mic
MH-19A2B Mini Earpiece Mic
MH-29A2B LCD Display Mic with Remote Functions
MMB-54 Mobile Mounting Hanger



No other dual band handheld beats the FT-530 on features for performance and ease of use. With the largest backlit keypad available, 82 memories, exclusive Dual CTCSS Decode and AM Aircraft Receive, the FT-530 is simply the best value there is.

Compare for yourself, then forget "the rest." See your dealer for the best dual band handheld you can buy. The FT-530.

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Performance without compromise.℠

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ICOM's IC-2GXAT . . . Powerful Versatility In A Rugged, User-Friendly Handheld.

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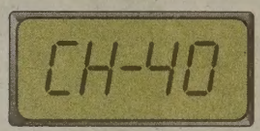
The IC-2GXAT offers surprisingly simple operation with the features and performance amateurs have come to expect from Icom products. Whether you're a beginner or a seasoned veteran, you'll quickly fall in love with this 2 meter handheld.

IC-2GXAT
2 Meter
FM Transceiver

SIMPLE OPERATION

Channel Operation – display can be set to indicate memory channel numbers only. This keeps frequencies secret, restricts operating frequencies or simplifies operation for an unfamiliar user.



Auto Repeater Operation – automatically activates the correct duplex direction when the receiver frequency tuned is within the repeater output frequency range.

Tone Scan – scans for, detects and sets the subaudible tone frequency to enable communication with another station that is using subaudible tones.

DTMF Redial– for quick and easy access to autopatches.

User Friendly Keyboard – uncluttered, user-friendly design for ease of operation.

ADVANCED FEATURES

Power Saver – reduces the current drain to 35 mA (avg. Rx) for battery conservation and extended operating time.

Low Power Option – switch to 1 W output power to extend your operating time when high power isn't required.

40 Memory Channels – store **all** repeater information independently.

Memory Transfer – the contents of a memory channel are transferred into VFO, **and the VFO mode is automatically selected,** to assure quick and easy QSY'ing.

5 DTMF Auto Dial Memories – for quick and easy autopatching to frequently used telephone numbers.

Selectable DTMF Autodial Digit Duration – adjust your DTMF speed to the decode capabilities of the repeater.

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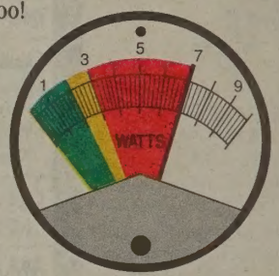
Call our brochure hotline:
(206) 450-6088

MAXIMUM POWER

7 W Output Power – one of the highest powers available in a handheld (nominal with 13.5 V DC or the optional BP-132A battery pack). The BP-132A battery pack provides more than enough power to reach those fringe areas, and a long lasting 600 mAh too!



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Die-cast Aluminum Rear Case – will withstand the demands of rugged outdoor use.

Splash Resistant Body – maintains performance in harsh outdoor environments.

Rated JIS II for splash resistance, the IC-2GXAT is built to withstand rugged outdoor use.

OTHER GREAT FEATURES

- High Sensitivity: 0.18 µV for 12 dB SINAD
- Multiple Scan Modes
- Monitor Function
- SET mode to customize transceiver operation
- Display lighting with 5 second timer
- Subaudible tone encoder, tone squelch and pocket beep
- Optional pager and code squelch
- BP-160 (3 W, 700 mAh) battery pack, wall charger, belt clip and hand strap come standard
- 8 tuning steps (5, 10, 12.5, 15, 20, 25, 30 or 50 kHz)
- Call Channel
- Icom compatible accessories

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